5-28-2019 12:00 PM

Cultivating Knowledge: Agrarian Science and Ecological Engagements in Southern Ontario Agriculture

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Graduate Program in Anthropology
A thesis submitted in partial fulfillment of the requirements for the degree in Doctor of Philosophy

Abstract

Agriculture and climate change are interconnected processes, with agriculture implicated in rising green house gas emissions, deforestation, soil and water pollution, and reductions in biodiversity. Conversely, changes within ecology (including a warming climate), alter growing conditions for farmers. Farmers face changes in both temperature and precipitation, as well as an increase in adverse weather events that significantly threaten productivity and livelihoods.

Based on 40 unstructured interviews as well as informal conversations conducted among farmers in southern Ontario, Canada between the spring of 2014 and the winter of 2017, this dissertation seeks to contribute to a growing body of work that focuses on the complex factors that shape farmer decision making in the face of environmental and climate concerns, while also paying particular attention to the role of farmers in southern Ontario as knowledge *creators*. This distinction is important in that it acknowledges that farmers are not just passive in the processes of adaptation, but are active in attempting to enhance their capacity and resiliency to climate change by taking part in practical experimentation and knowledge sharing.

In a departure from much of the climate change literature in Canada, my analysis attends to the complex relationships among species that shape both farmer identity and ecological knowledge. Multi-species intimacies are integral to farming life and shape farmer decision making in unpredictable ways. This dissertation also critically engages with the concept of "science-based" research. With an emphasis on farmers' contributions to enhancing resiliency to climate change while increasing environmental sustainability through agrarian science, this study examines the politics surrounding the concept of "science" and how it is manifested in discussions of agriculture and the environment in the Canadian context.

Farmers in southern Ontario are not just growing crops, they are "cultivating knowledge" by actively seeking out multiple sources of information, taking part in practical experimentation, and sharing knowledge with other farmers. This dissertation documents some of the ways these processes are unfolding as southern Ontario farmers seek to acquire and develop new methods of growing food that will help them adapt to the complex challenges associated with climate change.

Keywords

Climate Change; Agriculture; Ecology; Agrarian Science; Biodiversity; Resilience; Adaptation; Multi-species Ethnography; Knowledge; Slow Science

Acknowledgements

It would have been impossible to complete this body of work if not for the support and contributions of a number of individuals and organizations. To the many farmers who brought me into their homes and their fields, who fed me and shared with me, who told me of their experiences and let me into their lives—thank you. Without your willingness to share your experiences and wisdom, this research would not have been possible.

A special thank you to Karen who allowed my son to find eggs in her barn, pet her cows, and who always had words of encouragement. Your insight and support were invaluable. Thank you for bringing me to my first NFU-O local meeting and providing a gateway into the lives of farmers in southern Ontario.

Another special thank you to Linda who gave me the privilege of volunteering on her farm, who taught me the importance of hard work, who provided much food for my family, and who continuously challenged me to think beyond my own experience.

Thank you to the following organizations: the National Farmers Union of Ontario, the Ecological Farmers of Ontario, Seeds of Diversity, Everdale Farm, the Ontario Federation of Agriculture, OMAFRA, and the Rural Voice. There are many wonderful individuals in each of these organizations that answered my questions, welcomed me at conferences and field days, and contributed greatly to this research.

Thank you to the Social Sciences and Humanities Research Council of Canada, the Doctoral Excellence Research Award, the Ontario Graduate Scholarship, the Regna Darnell Scholarship for Fieldwork in Sociocultural Anthropology, and the Department of Anthropology at Western for funding my research.

Thank you to the Department of Anthropology at the University of Western Ontario. It is a privilege to be a part of a four-field department that is so integrated and supportive. A special thank you to my committee: Dr. Regna Darnell, Dr. Adriana Premat, Dr. Andrew Walsh and Dr. Tony Weis and to my external examiner Dr. Roger Lohmann. Your support and encouragement throughout my research has been invaluable.

To my advisor Dr. Andrew Walsh—I couldn't have done it without you. It has truly been a pleasure to learn from you.

To my son Sifen—you are my inspiration, my everything.

To my family: Mom, Dad, Steve and Dre—you encouraged me and always with love. Mom, you were right!

To Nathan—you were my rock, my best friend, and you constantly challenged me to be better. I couldn't have gotten here without you. Thanks for making grad school some of the best days of my life.

And to farmers everywhere—thank you for your stewardship and for feeding the world.

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1. Introduction—Confronting Climate Change and Agriculture

It was a cool morning in mid-November. The sun was shining and a few leaves clung stubbornly to the branches of the trees that shaded the driveway. The air smelled of wet vegetation with a slight tang of manure. Damp and decaying leaves littered our path and the gravel crunched under our feet as Edward[1] and I walked from the barn to the field where his sheep appeared to be enjoying the early morning sunshine. "Look", Edward began, "on climate change, one thing, they've got to get onto it. The world's got to get onto it. But we're not going to, because we just carry on and let things happen." As we walked, Edward shared the story of his growing up in Europe, of his decision to come to Canada with the promise of affordable land, and of his eventual abandonment of conventional farming methods.

Edward is an ecological farmer who has been active in promoting agroecology[2] in southern Ontario since the 1970s. Like other farmers I have met, he speaks frequently about the challenges in agriculture and the increasing difficulties of growing food in a rapidly changing climate. Edward and I spoke at length about the interplay of agriculture, ecology, and politics. As we commiserated about the current political situation I asked him what he thought farmers should be doing: "The same things as the Natives really. We've poo-pooed what they've said up until now, but now science is backing them up. The thing about science is, is that it's not true unless it's been proven according to their rules—the 'western' rules." As we talked about barriers to sustainability and meaningful change in agriculture, Edward stressed: "We've got to save more seeds and develop more seeds because our seeds can't change fast enough. In the past, they've had hundreds of years to change, but this is coming so fast. Things are just going to go extinct before they can adapt. We've got to be saving every darn seed that we possibly can. It doesn't matter

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[1] Throughout this dissertation I have changed the names of all participants in order to protect their identities, except in cases where the participant expressly prefers to be identified and acknowledged and where I have documented this preference on consent forms.

[2] Agroecology is the use of ecological approaches in agricultural systems. Essentially it involves taking into account the ecological impacts of agriculture and attempting to address them through the implementation of sustainable methods.

if it is a food crop or not, because the genetics in that plant might be the genetics we need."

Ecological farmers such as Edward are often advocates for biodiversity conservation, seed saving, knowledge sharing, and ecologically sensitive agricultural practices. In many ways, Edward is atypical of farmers in southern Ontario, most of whom have embraced chemically intensive (often referred to as "conventional" or "industrial") farming methods. In southern Ontario, the vast majority of farmers (approximately 98%) (Statistics Canada 2016) are conventional farmers who are farming using synthetic pesticides and fertilizers, using genetically modified or high-yielding seed varieties, and who are heavily invested in an industrial model of agriculture based on large-scale monocultures and intensive livestock operations. However, climate change has become an inescapable reality for all farmers with the potential to create areas of convergence in spaces typically characterized by difference. Although my sample size was small and I overwhelmingly spoke with ecological farmers, my interviews and discussions with conventional farmers illustrated that some are seeking out knowledge from ecological farmers and are experimenting with methods such as no-till and cover-cropping that can enhance the sustainability and resiliency of their farming systems while reducing their ecological impact. Although this cannot be said to be indicative of the overall picture of farming in southern Ontario as it comes from such a small sample size, it does suggest that the strict divide between conventional and ecological farmers may be somewhat messier than is often assumed. As all farmers will have to contend with the impacts of climate change, farmers with diverse cropping methods, products, and marketing strategies have the potential to learn from one another in an attempt to expand their knowledge base and increase resilience in the face of an uncertain future.

As issues surrounding climate change continue to capture the world's attention, the relationship between agriculture and the "dynamics of ecological destruction and sustainability" (Bernstein 2015) has become an important focus of research. Massive changes to Earth's ecology including the loss of biodiversity due to the adoption of industrial monocultures and the use of genetically modified organisms, have created

much debate (see Altieri 1999; Cardinale et al. 2012; Fitting 2011). Concerns over water, soil, and environmental sustainability have brought critical attention to the linkages between upstream and downstream interventions, implicated in the interruption of the cycle of land renewal necessary for sustainable agriculture (Goodman and Redclift 1991). Deforestation, soil and water pollution, reductions in biodiversity, erosion, and significant greenhouse gas emissions all contribute to our changing climate. Conversely, changes in ecology (including a warming climate) alter growing conditions for farmers. Farmers face changes in both temperature and precipitation, as well as an increase in adverse weather events that significantly threaten productivity and livelihoods.

Research into the impacts of climate change and agricultural adaptation in Canada have largely been fragmented in terms of issues studied and geographic region of focus (Wall et al. 2007). As such, "there has been little opportunity to compare different research perspectives, analytical methods, and results relevant to climate change adaptation in Canada's agri-food sector" (Wall et al. 2007:xiii). This dissertation seeks to contribute to a growing body of work that focuses on the complex factors (ecological, social, political, economic) that shape farmer decision-making in the context of environmental and climate concerns, while also paying particular attention to the role of farmers in southern Ontario as knowledge *creators*. This distinction is important in that it acknowledges that there are farmers who are not just passive or reactive in the processes of adaptation, but who are actively attempting to enhance their capacity and resiliency to climate change by taking part in practical experimentation and knowledge sharing. With more diversified farming methods and access to new technologies and social media, there are farmers in southern Ontario sharing knowledge well beyond their local communities, in some cases making connections that transcend international boundaries. Farmers like Edward experiment in their farming systems, seek knowledge from diverse sources, and pass on what they have learned. Many of the farmers who contributed to this research are active both politically and within their local communities, attempting to shape the future of farming in Ontario. While there is a considerable body of research on the potential

benefits of incorporating "local" knowledge in creating sustainable environments[3], this dissertation illustrates the complexity of knowledge sharing and shows that there are farmers incorporating knowledge from diverse sources and localities. This global knowledge is then built upon and may be applied in local contexts.

Farmers have an essential role to play in helping to curb greenhouse gas emissions while creating a more sustainable food system. The Food and Agriculture Organization of the United Nations (FAO) (2016) suggests that agriculture is directly responsible for about 14 percent of all greenhouse gas (GHG) emissions globally, but this figure only accounts for the emissions caused directly by production (i.e. agricultural equipment, soil management, methane production from bovines). When other factors such as deforestation, processing and transport, and food waste are accounted for, it is estimated that one-third of all anthropogenic greenhouse gas emissions come from agriculture (Jovanovic et al. 2015).

No matter what methods of cultivation are used, all agriculture has an impact on ecology. Edward, for example, practices polyculture, a form of agriculture in which a diversity of crops are grown simultaneously, crops are rotated, and often animals are included in the system. By contrast, industrial agriculture is based on monoculture: the practice of growing single crops intensively on a very large scale. Modifying ecology in the extreme, industrial agriculture relies heavily on chemical inputs and pesticides, damaging the soil, water, and even the climate on an unprecedented scale (Galt 2013). Planting the same crop over and over on the same land quickly depletes the nutrients in the soil on which plants rely on to grow. These nutrients must be replenished in some way, necessitating the use of chemical fertilizers. These fertilizers must be mined and transported, further amplifying environmental impacts.

Chemical fertilizers are implicated in massive changes to ecology in the form of soil and water pollution. Nitrates, phosphates, and pesticides leach into groundwater and

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[3] See Ellen 2007; Escobar 2008; Fitting 2011; Gupta 1998; Johnson and Hunn 2010 for some comprehensive discussions of the benefits of incorporating local knowledge in understandings of ecology.

pollute our waterways (Bouraoui and Grizzetti 2014; Dasgupta et al. 2015; Stehle and Schulz 2015). Nutrient overload leads to algae blooms that suppress aquatic plants and other animals while "increasing risk to human and wildlife health, concentrating potentially toxic biomass near shorelines where drinking water intakes and animals occur" (Pick 2016:1150). Similarly, the use of insecticides, herbicides, and fungicides reduce biodiversity by destroying insects, weeds, and non-targeted species, altering ecosystem functioning (Sluijs et al. 2015) As Verma and Srivastava reveal, "the indiscriminate release and accumulation of a wide range of pollutants in the environment (due to the fertilizers and pesticides used in agricultural practices) has led to the concentration of extremely stable and persistent chemicals and their breakdown products in the environment imposing hazardous effects on the living organisms that are exposed" (2017:159)[4].

Industrial agriculture is also a significant source of air pollution (Bauer et al. 2016). It is the dominant anthropogenic source of ammonia (from nitrogen oxide emissions from factory farms), which causes acid rain thereby damaging trees, acidifying soils, lakes, and rivers, and harming biodiversity (Ilea 2009). Burning of plant biomass (including deforestation) is another significant source of air pollution. Deforestation also limits adaptive capacity by reducing the number of trees available to absorb rising levels of CO_2 (Longobardi et al. 2016). The issue of "food miles", which is a factor used in assessing the environmental impact of food, has also garnered increased attention as the use of fossil fuels, both on the farm and in value-added processes, as well as export shipping as food moves from the producer to the consumer, have been implicated in rising CO_2 emissions (Kissinger 2012).

Increasing consumption of meat and the industrialization of livestock production is seen as both a force and a product of the current global food system, causing environmental degradation as more land is commandeered to feed livestock (at the expense of land used to feed humans). Intensive livestock operations continue to grow

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[4] See also: Helm et al. 2011; Naksen et al. 2016; Botias et al. 2016, for further discussion of the toxic impact of agrochemical pollution on ecology, including living organisms. Helm et al. (2011) explores the issue in Ontario.

globally, increasing greenhouse gas emissions (FAO 2016) and attendant environmental impacts. These operations are also changing human relationships with animals through the use of animal production facilities and feedlots which have been implicated in violent animal rights abuses (Weis 2007, 2013).

Potentially the greatest threat from industrial agriculture is the loss of biodiversity. Fifty percent of world food supply comes from just three crops—wheat, corn, and rice—and just a small number of varieties of these plants that are designed for intensive farming. The FAO (2016) estimates that of the approximately quarter of a million plant varieties available to be used in agriculture less than three percent are in use today. With disuse comes neglect and potential extinction. Biodiversity loss impacts adaptive capacity —essentially the ability to adapt and withstand the potential effects of climate change. So climate change, environmental sustainability, and the loss of biodiversity are not separate issues, but closely interconnected.

The flip side of this issue is that while agriculture is a massive contributor to greenhouse gas emissions and disruptions to Earth's ecology, farmers disproportionately feel the effects of climate change through increased flooding, drought, and increasing severity of adverse weather events which can cause catastrophic economic losses. Crop loss threatens farm livelihoods and negatively affects market prices, causing price increases to consumers while threatening global food security. Despite all of the issues I have outlined here, and the recognition of these issues by the United Nations and governments around the world, this problem is only getting worse.

Attempts to address the complex issues surrounding climate change and agriculture have led to diverse responses and technologies. Broadly speaking, there are high technology-based approaches such as: biotechnology (Genetically Modified Organisms); precision agriculture (the use of global positioning systems or drones in the measurement of inter and intra-field variability of crops); and nanotechnology (for detection and treatment of diseases, delivery of nutrients, etc). Many of these high-technology "fixes" are touted by the same corporations who have given us the industrial

agriculture system that has helped propel us to our current crisis. These solutions are based on techno-scientific ideas of efficiency and productivity and leverage political and scientific discourses in ways that promote the ability of specific technologies to overcome the challenges facing farmers without specifically addressing the impacts of agriculture on ecology. For example, nanotechnology seeks to overcome symptoms of unhealthy agricultural systems (such as a lack of nutrients or disease pressures) by delivering nutrients through nanoparticles or using imaging sensors to detect where applications of fertilizer or pesticides might be needed. This type of technology offers possibilities for ensuring productivity but fails to address the causes of soil depletion or the relationships in ecology that can contribute to specific disease pressures. This type of technology also does nothing to reduce the ecological impact of agriculture.

There are also ecological approaches to climate change adaptation and mitigation as it intersects with agriculture. These too are science-based, productivity focused and technologically sophisticated, however these approaches promote farming methods and technologies that seek to mitigate the effects of agriculture on climate change through a reduction in greenhouse gas emissions, while also increasing resilience through the preservation of biodiversity. Specifically, ecological approaches to agriculture seek to maintain productivity and profitability while utilizing production methods (such as cover-cropping and no-till) that enhance carbon sequestration, increase and maintain soil health, and avoid the use of chemical pesticides and fertilizers. While I have attempted to distinguish between these two approaches, the reality is considerably messier and there can be substantial overlap. In the context of agriculture in southern Ontario, farmers may adhere to one approach more strongly than another, but most of the farmers considered in this study do not fit neatly into a single category or approach.

Policies aimed at addressing climate change are being implemented at both the federal and provincial levels. The current Liberal Canadian government emphasizes “science-based” approaches to addressing the issues associated with climate change, but also acknowledges the importance of Indigenous knowledge and “local” knowledge in increasing adaptive capacity (Environment and Climate Change Canada 2018). Some

policy initiatives are directed at reducing emissions while also focusing on adaptation and resilience. Although agriculture is acknowledged as a significant contributor to greenhouse emissions, Environment and Climate Change Canada has not made agricultural sustainability a priority when it comes to policy initiatives. Their main areas of focus are: protecting human health in the face of a broad range of impacts associated with climate change; supporting particularly vulnerable regions; reducing climate change hazards and disaster risks (e.g. floods, wildfires, etc.); and building resilience through infrastructure (Environment and Climate Change Canada 2018). While each of these strategies is important, agriculture remains conspicuously absent and the importance of protecting biodiversity as a means of enhancing adaptive capacity is largely ignored. Although both environment and climate change fall under the purview of the same government ministry, there appears to be a lack of political commitment to the health and welfare of non-human species. This is particularly concerning in light of the fact that genetic and population diversity increase adaptive capacity for all species, including humans.

In a departure from much of the climate change literature in Canada, my analysis attends in part to the complex relationships among species that shape both farmer identity and ecological knowledge. Multi-species intimacies are integral to farming life and shape farmer decision making in unpredictable ways. Adopting a framework that attends to these intimacies has enabled me to develop fresh insights on the meaning and role of biodiversity in farmers' lives. This dissertation also critically engages with the concept of "science-based" research. With an emphasis on farmers' contributions to climate change mitigation and environmental stewardship through their own practical experimentation and knowledge sharing (science) this study examines the politics surrounding the concept of "science" and how it is manifested in discussions of agriculture and the environment in the Canadian context. My fieldwork indicates that farmers critically reflect on the use of science as a tool of those in power. In some of the cases I consider, increasing mistrust of corporations, government oversight, and academic institutions has contributed to an intensification in farmer-led research that seeks to empower farmers while increasing

their resilience in the face of a changing climate. Ultimately, this dissertation documents the great potential that many of the select group of farmers' I have spoken with see in incorporating ecological approaches to agriculture—approaches that may both increase resilience in the face of climate change, while also decreasing the burden of agriculture on ecology.

Two recurrent themes emerged throughout my research. The first is the concept of trust. Although the word "trust" does not appear in any of my textual analysis, it was implicit throughout my discussions with farmers. When accessing or applying new information, trust is integral, especially within the context of agriculture when one wrong decision could have catastrophic consequences. Farmers must trust the source of their information before they will consider integrating that information into their schema. Although farmers do take calculated risks and experiment in their farming systems, they actively seek out information they believe they can rely on to help buttress their existing knowledge base. Trust is not freely given. It is something earned and that must be built through relationships. How this manifests among the farmers I spoke with is complex. Many favoured experiential knowledge. They liked to learn from their own experiences and experimentation as well as from others who have experimented with similar processes. They learned as much from their own and other's failures as they do from their successes. In many discussions, farmers I spoke with were explicit in their concern over the manipulation of science by large corporations and governments. This created a sort of "cognitive dissonance" (Festinger 1957)[5] as many of the farmers that took part in this study readily acknowledged the importance of scientific research while also being skeptical of its application by powerful actors. Living in a society where "science-based" research is given high credibility, many farmers I spoke with struggled to reconcile claims-making that sometimes differed strongly from their own experiences.

The other theme that manifested throughout my research was a principle of care. Sometimes framed as stewardship or even protection, notions of care were prevalent in

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[5] In the field of Psychology, "cognitive dissonance" refers to feelings of mental discomfort that occur when a person is confronted with evidence that stands in contrast with his/her beliefs.

my study. Although agriculture requires extensive modification of ecology which can have negative consequences for plants, wildlife, soil and water health, the sample of farmers I spoke with expressed and performed care in a multitude of ways. Animal husbandry, providing nutrients for plants and soil, fighting for changes in policy, and making connections with family and community, were just a few ways in which caring was performed. Care is also politicized and oppressive as farmers are told how they should care, about what they should care, and why. This is especially the case in discussions of ecology and climate where farmers are increasingly called upon to perform care and take responsibility for environmental management. A number of farmers who took part in this research expressed frustration and resentment at being told how they should manage their farming system by consumers and policy-makers who appeared to have little understanding of the realities of farm life.

The title of this dissertation ("Cultivating Knowledge") is a playful attempt to engage with the multiple definitions of "cultivation". The Oxford English Dictionary (2018) defines *cultivate* as: "to prepare and use land for crops or gardening; in biology—to grow or maintain living cells in culture; and to try to acquire or develop a quality or skill". The southern Ontario farmers on whom this thesis is based are not just growing crops, they are "cultivating knowledge" by actively seeking out multiple sources of information, taking part in practical experimentation, and sharing knowledge with other farmers. This dissertation documents some of the ways these processes are unfolding among a small group of farmers in southern Ontario as they seek to acquire and develop new methods of growing food that will help them adapt to the complex challenges associated with climate change while also decreasing the ecological impacts of agriculture.

1.1. Research Area

Southern Ontario, Canada, is an area of incredible ecological diversity. Stretching along the Great Lakes basin from Lake Huron to the west, and along the shores of Lake Erie, Lake Ontario, and the St. Lawrence River Valley to the south, the area is rich with

freshwater lakes, rivers, and tributaries. Many of the swamps and wetlands of the region have been replaced by human development, but there is still evidence of bogs and marshes throughout the region (Ministry of Forestry and Natural Resources 2018). Forests of mixed deciduous and evergreens (much of which have been cleared for cropland), as well as vast areas of grassland prairie and savannah characterize the landscape. There are areas of relatively flat land interspersed by gently rolling hills. The bedrock is primarily Silurian and Devonian limestone along the Great Lakes watershed (Ministry of Forestry and Natural Resources 2018).

The geographical area in which I conducted my research consists of two ecoregions as defined by the Ministry of Forestry and Natural Resources (2018) (see Figure 1). The first is referred to as the Lake Simcoe–Rideau ecoregion (Ecoregion 6E). The climate of this region is warm and humid. More than 57 percent of the land in this ecoregion consists of cropland, pasture, and abandoned fields, and this area is the second most populous region in Ontario (Ministry of Forestry and Natural Resources 2018). The second ecoregion is the Lake-Erie–Lake-Ontario ecoregion (Ecoregion 7E). This area is the southernmost region in Ontario. The rationale for the creation of a boundary between these two ecoregions is based on the contact zone between Paleozoic and Precambrian bedrock at the northern boundary, and also with precipitation and temperature variables (Ministry of Forestry and Natural Resources 2018). Its southern boundary is correlated with temperature, elevation, geological differences, and estimated net primary productivity (Baldwin et al.1998). Both are classified in the Humid High Moderate Temperate Ecoclimatic Region (Ecoregions Working Group 1989) with Ecoregion 7E having one of the warmest climates in Canada. Summers in this region are long, hot and humid, and winters are cool (Ministry of Forestry and Natural Resources 2018).

The flora and fauna of this region (7E) are the most diverse in Canada (Ministry of Natural Resources and Forestry 2018). However, many species are at risk due to habitat loss caused by agriculture and urban development and encroachment. Water and air pollution, as well as climate change, are also a threat to species diversity in the region. “About 78% of the ecoregion has been converted to cropland and pasture, and developed

FIGURE 1: ECOZONES MAP: MINISTRY OF NATURAL RESOURCES AND FORESTRY, GOVERNMENT OF ONTARIO 2018.

My research area extended throughout the areas coloured in red and pink from ecodistrict 7E-1 in the far south-western corner of the province, to as far east as ecodistrict 6E-8.

land (e.g., urban areas, industrialization, and road networks) encompasses more than 7% of the ecoregion" (Ministry of Forestry and Natural Resources 2018). This ecoregion is

also the most heavily populated and urbanized region in all of Canada (Newbold and Scott 2013) and includes Toronto, Canada's largest city.

This region has some of the most arable land in all of North America. In fact it has more than half of the highest quality agricultural land in Canada, with farmers here accounting for almost a quarter of all agricultural revenue (Government of Ontario 2014). This verdant and fertile land produces an immense variety of food for both local consumption and export, including: vegetables, fruit crops, poultry, hogs, beef and dairy, as well as cash crops such as soybeans, corn, wheat and barley. As of the 2011 census, most farms in southern Ontario were still considered "family farms", with over 60 percent of farms under 163 hectares (402 acres) (Government of Ontario 2014). "Family farms" vary greatly in size and production capacity and are defined as such (however informally) in terms of land ownership, as well as the condition that the majority of farm labour is conducted by members of the family owning the land. Although the majority of the small sample of farms considered in this study relied solely on labour from family members, three farmers said they also used migrant labour during harvest, and most relied on the help of neighbours or seasonally hired locals during times of increased productivity.

The farmers I encountered during my research were overwhelmingly of European descent. Many described immigrating from European countries and I spoke with farmers from England, Germany, Sweden, Switzerland, the Netherlands, and Belgium. Several others were second or third generation Canadians who described their families as having immigrated from Europe and who had surnames that suggested European heritage. These demographics reflect Canada's colonial legacy and immigration policies that historically favoured immigrants from Europe. According to the 2016 Canadian census, most respondents who declared a cultural or ethnic origin other than Canadian were from countries in Europe. The top five ethnic origins that respondents claimed were: English, Scottish, Irish, French, and German (Ontario Ministry of Finance 2017). However these demographics are changing—especially in Ontario's urban centres. "Asia and the Middle East were by far Ontario's largest source of immigrants between 2011 and 2016, with

68.8% of newcomers arriving from the region" (Ontario Ministry of Finance 2017). Ontario welcomes 39 percent of Canada's new immigrants, most of whom are settled in southern Ontario's larger cities and towns (Statistics Canada 2017). The 2016 Census enumerated 2,705,550 foreign-born individuals in the Toronto Census Metropolitan Area, comprised of 70.2% of Ontario's, and 35.9% of Canada's overall immigrant populations (Statistics Canada 2017).

Southern Ontario's urban centres reflect a great deal of cultural diversity, however this does not extend to the province's rural areas. This may be in part because land prices have risen precipitously in recent decades meaning new immigrants may have a difficult time purchasing the land needed to pursue agriculture. This is a relatively new concern as my research in the farming community indicates that many Europeans were lured to Canada by the promise of affordable land. Extremely high land prices mean that many young farmers and new Canadians who wish to work in agriculture are forced to work as interns or be part of cooperatives until they can save enough to purchase their own land (see Laforge et al. 2018). These realities inevitably shaped the research encounter leading to a relatively narrow group of potential research participants in terms of age and diversity.

1.2. Research Methods—Methodological Malleability

This dissertation is based on fieldwork conducted among farmers in southern Ontario, Canada from the spring of 2014 through the winter of 2017. This research was conducted intermittently, as opposed to an immersive fieldwork experience. As a result, some weeks would include very little fieldwork and might include a trip to a farmers' market and taking part in recruitment activities such as trying to solicit interviews via email. Other weeks might include more intensive research activities such as attending a field day and a union local meeting, visiting a farm for an in-person interview, and conducting a phone interview. Over the course of my research I conducted 40 unstructured interviews with farmers. Four of these farmers I had met previously through union local meetings and field days. These interviews were casual and conducted as informal conversations.

However, I would sometimes steer the conversations to create opportunities to discuss issues of particular interest to my research, or to discuss topics which had been brought to my attention through other interviews. I also had phone interviews with four farmers, and two farmers answered questions via email. I solicited and received information via email from the Ontario Ministry of Agriculture and Rural Affairs. I had informal discussions with dozens of other farmers at union local meetings, farmers markets, conventions, trade shows, and agricultural conferences—what Geertz (1998) would describe as "deep hanging out". I also took part in field days where I had the opportunity to observe how farmers share information and are innovating within their unique ecosystems.

My fieldwork also included a week of 8-10 hour days volunteering on an organic farm where I spent time doing agricultural labour such as: haying, cleaning out a chicken barn, painting a trailer, collecting eggs, feeding pigs, and weeding a potato field. I spent time at kitchen table meetings where farmers connect to share information and socialize. I monitored online forums such as The Canadian Family Cow, Cheese Forum, and Ontag farms, where farmers shared their questions, concerns, and triumphs with other growers from around the world. I also spoke with people on the periphery of agriculture, such as academics, activists, and allies including representatives of the Ecological Farmers of Ontario, Seeds of Diversity, Everdale Farm, the Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA), the Ontario Federation of Agriculture, and Alternative Land Use Services (ALUS).

My research included spending time speaking with farmers who defined themselves as conventional, organic, ecological, and simply "farmers". I spoke with both women and men and interviewed a number of couples together. My interviews were conducted with twelve women, twenty-four men, and four couples. I visited both small farms (under 100 acres) and larger farms (one of them a poultry farm with over 10,000 birds). Although I visited 10 conventional farms where there was strong adherence to an industrial agriculture model and also spoke with dozens of conventional farmers at conferences and events such as those sponsored by the Ontario Federation of Agriculture, the majority of my interviews were conducted with family farmers who either described

themselves as “organic” or “ecological” (although most had been conventional farmers at some point in their lives). I think the reasons for this are complex, but I believe the political and philosophical position of farmers who claim organic or ecological orientations predisposes them to be more willing to participate is social science research, especially with a topic such as my own.

Although I actively attempted to recruit a more representative sample of southern Ontario farmers through advertising in the Rural Voice and attending events frequented by conventional farmers, ultimately my research represents a very small sample of a distinct minority of Ontario farmers. According to the 2016 Canadian Census, just 1.5% of farmers in Ontario are certified organic. Although I spoke with a number of farmers who used ecological methods but were not certified organic (and were not represented statistically), their overall numbers are likely very small. I think it would be reasonable to assume that the bulk of my sample comes from the approximately 2% of farmers in southern Ontario that farm outside of the conventional model of agriculture.

I was born in southern Ontario and I spent much of my childhood living in a small town with a population of 900 people. Although I have never lived on a farm, the town where I lived was surrounded by agricultural land and many of the children who attended school with me were from farming families. Strathern argues “that as ethnographers, anthropologists on familiar terrain will achieve a greater understanding than elsewhere, because they do not have to surmount linguistic and cultural barriers” (1987:17). It is true that coming from a rural background conferred some advantage in my gaining the trust of my research participants. I often began my interviews by telling farmers where I grew up and stressing that although I was familiar with some aspects of farming, there was much I did not know. I would joke about having become “citified” after having lived in urban centres for much of my adult life. My personal and research experiences with farmers in southern Ontario suggests that many of them reify the urban/rural divide, with a somewhat protective and romantic idealization of rural life over life in the city. Although being from rural Ontario did break down some of the barriers inherent in doing ethnographic research, I also experienced the unique methodological challenges faced by

anthropologists who do research “at home”. According to Narayan, having roots in a locality does not always mean that an anthropologist is a “native returning home to blend smoothly with other natives”(1993:675). Although I had grown up in rural southern Ontario, I knew little about farming and had lived in larger cities for decades. My awkwardness was readily apparent during on-farm visits where my slight fear of cows and my inability to properly size my rubber boots became the basis for much laughter at my expense.

In order to find research participants I employed diverse methods of recruitment. I reached out directly to organizations such as the National Farmers Union, the Ontario Federation of Agriculture, and the Ecological Farmers of Ontario. These initial contacts led to invitations to union local meetings, and to a number of interviews that were conducted over the phone. I also gained information regarding upcoming events where I would be able to meet other farmers. Attending union local meetings, farm conferences, and events sponsored by the Ecological Farmers of Ontario gave me proximity to potential participants. Although I did reach out to organizations such as the Ontario Federation of Agriculture and the Grain Growers of Ontario, as well as advertising in an Ontario agricultural newspaper, I also specifically sought out ecological organizations. Favourable responses from the National Farmers Union and the Ecological Farmers of Ontario seriously shaped and necessarily limited my sample as these organizations represent a minority of Ontario farmers.

Spontaneous conversations expressing my interest in issues of ongoing concern to farmers would sometimes lead to fruitful conversations or invitations to visit their farm. I advertised for a number of consecutive months in the Rural Voice, an Ontario newspaper targeted at farmers. This avenue was not particularly fruitful considering the cost involved, however it did provide me with the ability to make my research known to a larger number of farmers and this particular recruitment method yielded some phone interviews from farmers outside my immediate research area which offered important avenues for comparison. After making initial connections with farmers, I would often

exchange contact information and would follow-up either by phone or email to try and schedule a farm visit and interview.

Seasonality affected my fieldwork. I conducted many of my interviews during the winter months when farming activities are somewhat reduced as fields lay dormant. Winter was also the time for attending agricultural conferences. During the spring, summer and fall, I would attend events that were focused on farmer-to-farmer knowledge exchange. Many of these were sponsored and organized by organizations such as Everdale Farm or the Ecological Farmers of Ontario. I would register and pay to attend these events, travel to farms throughout southern Ontario and take part in field days where I would learn about different crops and farming methods alongside other farmers. These events provided some of the best opportunities to see the dynamics of farmer knowledge exchange in action. I also met a number of farmers at these events who subsequently invited me to visit their farms and were willing to be interviewed.

Despite my willingness to take part in agricultural labour and my offers to do so, only one farm took advantage of my offer of free labour and even they were reluctant in the beginning. This was unfortunate as I missed out on learning more about how farmers plant, fertilize, and make land management decisions. I was not able to ascertain the exact reasons for this, however I think my status as researcher may have been a contributing factor. Or, just as likely, my age, awkwardness, and the fact that I hailed from the city might have given the impression that any benefits my labour might have provided would be offset by the efforts needed to oversee and direct my endeavours. My being on farm during these activities could have been intrusive and would likely have delayed completion of the work.

Ultimately, my status as researcher and my position as both insider and outsider inevitably shaped the research encounter. My use of consent forms proved to be a barrier and reinforced my position as an outsider. Especially in cases where I had taken part in informal conversations that led to future farm visits, the use of consent forms interrupted the development of a relationship that had begun unfolding in a casual manner. Some

farmers were not interested in reading or signing the consent form. In those cases, I summarized the contents and the purpose of my research and received verbal consent, which was recorded. In anticipation of this challenge, I began emailing my participants copies of the research consent prior to my visit while making lighthearted jokes about the nature of academic bureaucracy. I found this strategy particularly helpful in alleviating some of the discomfort with the formality of the research encounter.

Anthropological methods are diverse and often context specific. I took part in participant observation at field days and while conducting farm labour. I conducted informal interviews at farms and at coffee shops. I had casual conversations at conferences, conventions, union meetings and farmers markets. I asked pointed questions of government officials and emailed more formal interview questions to certain participants. This methodological malleability allowed me to seamlessly transition from farm to conference, and from researcher to field hand, while giving me the opportunity to consider thoughtfully my encounters with human and non-human species alike. Methodological flexibility allows the researcher to adapt to complex circumstances, such as navigating between the biological and the social—domains which are often considered separately. Ecologists have traditionally sought to study ecosystems in their "natural" state, away from the confounding influence of human activity (Gallagher and Carpenter 1997). Their ideas "were founded on the conception of 'nature' and human society as separate entities, thus ignoring the role that Indigenous and local communities have played in shaping many globally important ecosystems through processes of co-evolution" (Colchester 2003 cited in van Oudenhoven et al. 2010; see also Escobar 1999). The concept of co-evolution is key. Human/ecology relationships are co-constitutive and anthropological methods lend themselves well to this type of analysis as anthropologists have long sought to understand the relationships between humans and their diverse environments. This is especially important in discussions of agriculture where human/ecology relationships are messy and have ramifications far beyond local ecologies.

1.3. Theoretical Approach

As I settled down to write this section on theory I recalled a conversation I had with a farmer very early in my fieldwork. We had just sat down to a hearty lunch of roasted potatoes, pasta salad, ham, and leftover roast beef. The smell was intoxicating and I was hastily filling my plate when Klaus asked, "so what are you going to do with all this stuff that you are learning from us?" Nodding with a mouthful of food I said, "I'm going to write about it". Klaus prodded me for more. "You're just going to write down everything we tell you and that's going to get you your degree?" Between bites of food I summarized a bit of what it is like for an anthropologist and I mentioned the importance of situating my own fieldwork within theory and the literature of anthropologists and other academics that have come before me. He asked me for an example, so I briefly defined political ecology. I explained that political ecology was an approach to studying nature–society relations that had emerged out of interactions between a number of disciplines such as biology, geography, political science, economics and anthropology (Little 2007:85). I described how political ecology attempts to understand issues of environmental concern within the context of wider relationships to politics and the economy (see Watts 1983, Blaikie 1985, Bassett and Peimer 2015). Although this was a simplified explanation of the diverse theoretical and methodological approaches that characterize political ecology, I thought my definition was enough to help describe the processes that researchers go through to situate their work. Klaus sputtered and then laughed. I smiled, but I think Klaus could tell I didn't quite get the joke because he elaborated, "That's what you academics spend your time doing at the universities? You might have some book smarts, but maybe not so much practical smarts. What you just described is just common sense!" He laughed again and I laughed with him, but not without some discomfort. I have struggled, both during my fieldwork and while writing, to find some meaning in the work I am doing. I am not naive enough to think this research will have a significant impact on the farmers who so graciously volunteered their time and knowledge, nor will it contribute to some grand theoretical insight that will change the way we think about ecology, agriculture, or climate change. Fieldwork and writing often seems like an

exercise in futility, or worse, self-flagellation—an anemic attempt at contributing something with meaning.

Klaus's description of theory (specifically political ecology) as "common sense" isn't wrong, but it's not exactly right either. At times, theory is burdensome—weighty with ideas and difficult to wade through. At other times, it is elegant—showing us the way and providing insights (however brief and incomplete) into the complex ways of being that make us human. The real struggle I have with theory is not really about theory at all. It's about expectations. When sifting though theory I attempt to seek out an explanatory model that might provide some satisfactory feeling that I have things figured out (or that somebody does). Roy Ellen declared that he "was always uncomfortable with such posturing, and with the idea that there was somehow a mix-and-match market-place of ideas in which you might acquire the right aesthetic and ideological combination" (2010:387). In actuality, the "truth" is illusory and ever-changing. It's always just turtles all the way down (Geertz 1973; King 2013).

However inadequate theory might be in providing grand explanatory models about the complex matters that shape our world—it is good and sometimes fun to think with. As Ellen suggests, "Theory should not be something that constrains and terrorizes, but rather something that serves and liberates us" (2010:388). It also serves another purpose—it "defines us as scientists, scholars, researchers, and individuals, and in terms of the perceived quality of our work" (Ellen 2010:387). This makes me uncomfortable—the idea of performing expertise. This dissertation explicitly seeks to acknowledge the importance of other ways of knowing and unsettle the privilege that accompanies the performance of scholarly knowledge or expertise. As I write, I feel constrained by language and my engagement with the literature, precisely because I know that I must achieve a certain benchmark of engagement with scholarly work, and that my writing should be accessible, yet not so accessible that it fails to perform the level of expertise required at this stage of my academic career. As a political project, I want to disrupt the privilege that is often associated with claims to scientific expertise and acknowledge the important contributions of messier ways of knowing, (such as the ecological knowledge

held by agrarian citizens), while acknowledging that farmers too must perform expertise (see Lefevre et al. 2014). Yet in order to do that, I must assert my own authority and in many ways reinforce the same system I seek to undermine.

Anthropologists, like other social scientists, are adept at dipping our toes into theoretical waters, trying things on for size, manipulating and challenging ideas and hopefully creating something new and worthwhile in the process. In this dissertation I adopt the theoretical eclecticism favoured by many anthropologists. I engage with theoretical insights from diverse bodies of work, (apart from my essential commitment to the social sciences), including biology, archaeology, geology, psychology, and literature. Although heavily influenced by critical theory, I also engage significantly with evolutionary theory from a materialist perspective. Most notably, my research is situated within a comprehensive body of work that encompasses political ecology, multi-species ethnography, and the politics of knowledge (Science and Technology Studies, Citizen Science, Ethnoecology, etc.).

Little (2007) suggests that "for a truly ecological science to exist, a sustained dialogue between the social and the natural sciences focusing on the dynamic and interdependent relationship between the biophysical and social worlds, is necessary" (2007:87-88). Vayda and Walters (1999) are critical of much of the political ecology literature due to its emphasis on political dimensions without adequate attention to biophysical dynamics. My research fits within these discourses by acknowledging the primacy of evolution as a grand explanatory theory, and the material consequences of human interactions with the rest of ecology, while acknowledging how "people inscribe their life worlds, in particular biophysical environments, by using, inhabiting and/or managing these according to their ideologies, knowledge and socioeconomic political power. In doing so, people generate environments, environmental knowledge systems and territory" (Boelens et al. 2016:3). My research is predicated on the presumption of the validity of evolutionary theory and the consequences of genetics, while at the same time engaging critically with the kinds of scientific claims-making that professes certainty while attempting to address complex problems. This is particularly problematic in

discussions of climate change and ecology where borders are messy, including our understandings of concepts such as "species" and "biodiversity" which are more flexible than one might suppose. This may seem counter-intuitive, but my research can be situated with other theorists advocating a "biocultural synthesis", which proposes a unified theoretical framework based on contributions from multiple disciplines (Goodman and Leatherman 1998). As Jens-Christian Svenning reveals "A long-term ecological and biogeographic perspective is an important art for living on a damaged planet: it helps us both to see what factors have slipped away from our present-day landscapes and ecosystems to imagine how we might overcome their absences" (2017:G67).

Multi-species ethnography has emerged in anthropology in part as a response to an increasing focus on climate and environment related issues, including recognition of the "Anthropocene" as the current geological era in which humans have become "the main geological force shaping the face of the earth" (Latour 2014:139). A growing body of work is attempting to "bridge the ontological divide" and move beyond the boundaries of "nature" and "culture" to widen the scope of our regard, including taking into account the other-than-human and recognizing multiple knowledge constructions (Bessire and Bond 2014). The impetus behind this movement is both moral and political and stems from the belief that reification of these categories has helped propel our current planetary crisis. Multi-species ethnography "centres on how a multitude of organisms' livelihoods shape and are shaped by political, economic, and cultural forces" (Kirksey and Helmreich 2010:545). Sahila Galvin explores the recent interest in multi-species entanglements among anthropologists, while acknowledging that these relationships have long been a focus, especially in sociocultural research among agrarian societies (2018:234). The article examines recent contributions to multi-species scholarship but asks: "why is it that recent work pays so little heed to a rich disciplinary legacy that has attended to interspecies relations in agriculture?"(Galvin 2018:236). This is a valid question. Anthropologists who undertake multi-species ethnography are not newcomers. In fact, incorporating the non-human in ethnographic fieldwork may be seen as a revival. As Kirksey and Helmreich reveal, "studies of animals have a long lineage in anthropology,

traveling back to texts such as Lewis Henry Morgan's 1868 The American Beaver and His Works", which documented details of the livelihoods of beavers and drew parallels between their engineering knowledge and that of humans (2010:549). Alan Smart similarly argues that bringing other species into anthropological inquiry is reminiscent of classical ethnography (2014:4). However, as Faier and Rofel (2014) note: "earlier scholarship is described as taking a rather singular, human-centered view of agency, reflecting an anthropocentric privileging of human impacts on nonhuman worlds" (cited in Galvin 2018:235). I would argue that this is still a feature of much multi-species scholarship, especially in the context of ecological and climate concerns where emphasis on the "Anthropocene" centres *anthropos* as the driving force behind ecological concerns, including climate change.

When I began my fieldwork I did not intend to use multi-species frameworks. I had been exposed to multi-species ethnography and it was fascinating in the way that theory can be without seeming particularly relevant to your own research. However, once I entered the field it soon became apparent that understanding the complex intersections of agriculture, climate, and ecology necessitate a serious consideration of multi-species entanglements. Sites of agricultural production are what Ogden refers to as "assemblages of collective species, the products of collective desires and the *asymmetrical* relations among humans and non-humans" (2011:28, emphasis added). Considering multi-species entanglements within the context of wider ecological relationships then became more of a necessity than a conscious choice. The farmers with whom I work are acutely aware of their relationships with other species and of the complex processes and interactions that are critical in the food web. Plants and animals are entangled with labour, economics, and farmer identity, and shape knowledge acquisition in ways I had not previously considered, but that are integral when examining the assemblages that shape ecology and contribute to a changing climate. My research can be situated in these discussions by emphasizing the interconnections between humans and the rest of ecology and the necessity of considering these relationships seriously if we are to survive as a species. This dissertation does not focus specifically on relationships between farmers and the

animals in their care, but instead asks the reader to consider how a farmer's relationships with all species in ecology shape both knowledge acquisition and application, and also what it means to be a farmer. The farmers I worked with communicated very specific understandings of ecology that developed out of these relationships, and the impacts of farmer decision-making and labour have impacts that reverberate throughout ecology. We need to consider these relationships carefully.

Within discussions of ecological concern and multi-species entanglements are debates surrounding the politics of knowledge. These discussions include interrogations of the politics surrounding scientific knowledge claims and a call for greater recognition of "multiple knowledge constructions and ontologies" (Goldman and Turner 2011:17). Set within wider discussions of environmental politics, an emerging area of Science and Technology Studies (STS) highlights the persistence of scientific uncertainty and the fact that all knowledge (including "western science") is constructed (see Latour 1993, 2014; Stengers 2010, 2011). Critical ecopolitical discourse argues that we are seeing "the violent impacts of scientific practice on people and environments" (Goldman and Turner 2011:17) (see also Agrawal 1995; Shiva 2013). These critiques emphasize the unequal power dynamics that render "informal" knowledge subordinate to more formalized science.

Forsythe and Walker examine how environmental problems and scientific knowledge are connected through what they describe as "problem closure" (2008:12). They discuss how "dominant environmental narratives often depend on simplified characterizations of ecological systems that are far more complex and uncertain than assumed" (in Bassett and Peimer 2015:160). This tendency toward reductionism and oversimplification is highly problematic when seeking to address such complex challenges as the relationships within ecology that contribute to climate change. Although we have gained much important knowledge and an expansive understanding of ecology as a result of reductionist science, there is also much that is missed by taking this approach. As Rigg and Mason assert, "the tendency of modern science to reduce complex phenomena into their component parts has many advantages for advancing knowledge.

However, such reductionism in climate science is also a problem because it narrows the evidence base, limiting visions of possible futures and the ways they might be achieved" (2018:1030). In accordance with other research that seeks to understand the role of diverse ways of knowing (Indigenous knowledge, traditional ecological knowledge, ethnoecology, etc.) in helping to address the complex challenges associated with climate change, this dissertation explores the potential benefits of incorporating agrarian science in discussions of climate change mitigation and adaptation strategies in southern Ontario agriculture.

1.4. Chapter Structure

The chapters of this thesis are organized in a way that is intended to highlight agriculture as a form of modification of ecology and the complex factors that shape sustainability and resiliency to climate change in southern Ontario. I am especially interested in documenting the role of a distinct groups of farmers as agrarian scientists and how practical experimentation and relationships with others shape knowledge acquisition, transformation, and utilization. Ultimately, I consider the extent to which practical experimentation and knowledge sharing are inspiring social, technological, and ecological innovations with the potential to increase adaptive capacity while reducing agriculture's impact on ecology. Critically engaging with definitions of "science" I attempt to disrupt the hierarchy between different kinds of knowledge and argue for the integration of diverse perspectives, specifically within the context of our understandings of ecology. Throughout my analysis, I seek to relocate *anthropos* within ecology and to interrogate the ways in which current social and ecological pressures are changing things for some farmers in southern Ontario.

Climate change and agriculture are highly integrated processes involving social, political, economic, and ecological networks that have evolved as a result of particular historical trajectories. In Chapter 2 I discuss some of the major transitions in the history of agriculture that have led to our current ecological crisis. After acknowledging the realities of constant geological, atmospheric, and biological change in Earth's history, my

analysis proceeds first from the Neolithic Revolution to the "Age of Capital" (Moore 2016). I then use the framework of "Food Regimes" (Friedmann and McMichael 1989) to discuss the role of agriculture in colonial expansion and industrialization. I subsequently explore the current state of farming in southern Ontario and consider the specific ecological, social, political, and economic challenges facing farmers. Analyzing the motivations behind the choices made by the farmers I interviewed, I examine the role of farmers as both ecological and political beings and how the navigation of these contingent and sometimes conflicting roles reveals unique challenges. Finally, I use the debate over neonicotinoid pesticides to consider how these farmers frame biodiversity, adaptation, and resilience in an ideological debate about what forms of agriculture are considered "sustainable".

In Chapter 3 I examine the importance of relationships in shaping farmer identity and knowledge acquisition. After a "phenomenological foray" into farming, I consider the importance of trust, acknowledging the human relationships that contribute to identity formation and learning. I then move beyond the human to interrogate how these processes involve farmers' interrelationships with other species. After demonstrating how the farmers I worked with discuss these relationships, I consider how multi-species connections intersect with the politics of production leading to sometimes unpredictable or contradictory behaviour.

Chapter 4 explores the role of farmers as agrarian scientists, innovators, and generators of knowledge. Making connections to the discussions of adaptation in Chapter 2 and relationships in Chapter 3, I discuss how the farmers I worked with engaged in processes of practical experimentation and innovation, and how information is shared, accessed, transformed, built upon, integrated or discarded. Embracing a holistic vision of the term "science" I advocate for a broader understanding of scientific principles and an acknowledgement of the role that agrarian science can play in creating greater understandings of ecological relationships.

In Chapter 5, I use case studies of three farmers to illuminate the changes that are occurring in southern Ontario agriculture as a result of the current social, political, economic, and ecological "climate". Considering farmer motivation for creating change, I examine the role of farm organizations and communities of practice, and the specific strategies that are currently being utilized to enhance resiliency in the face of increasing uncertainty.

Finally, I conclude by reflecting on the challenges facing farmers and their allies and propose a *politics of mutual enhancement* that includes embracing "slow science" (Stengers 2018) to encourage a more hopeful gaze in the face of an uncertain future. Ultimately, these chapters demonstrate the ways in which a small group of farmers in southern Ontario are navigating uncertainty in the face of climate change and the potential of their role as knowledge creators in helping to enhance ecological relationships for a more sustainable future.

2. Living and Farming in the "Capitalocene"

We are currently living in a time of profound ecological change in which rising greenhouse gas emissions, the acidification of oceans, loss of biodiversity, deforestation, global poverty, and mass species extinction indicate that a systemic crash may have already begun (Virilio 2007). Humanity exists on the precipice of what is being called the "Sixth Great Mass Extinction" (Steffen et al. 2007). Human populations have transformed our planet so fundamentally that a new conceptualization of geological time that includes humanity as a "major geological force" has become necessary (Moore 2016:3). Dubbed the "Anthropocene" by Paul Crutzen and Eugene Stoermer (2000), this new geological era has dominated academic rhetoric in the environmental sciences for at least the past decade (Moore 2016:2), with research focusing on the relations between society and nature, and on the ecological effects of capitalism and state development from the Industrial Revolution through to the present. Emphasis on the ills associated with "modernity" (Cartesian dualisms, ideas of progress, anthropocentrism) permeate the literature. Recent critiques (see Altvater 2016; Crist 2016; Haraway 2016; Latour 2017;

Moore 2016) suggest that we go back further in world history to the “Age of Capital” or the “Capitalocene”, to interrogate “the era of capitalism as a world-ecology of power, capital, and nature”(Moore 2016:6). What these discussions have in common is an attempt to deconstruct how humans, as a species living in multi-species assemblages, have altered Earth’s ecology to such a dramatic extent that we have come to a point in our species’ history where our very ability to survive may be at risk. As I navigate the complexities of these issues, my use of the term “Anthropocene” does not assume a homogenous human race (Gan et al. 2017:G3). I acknowledge that not all individuals and societies are equally complicit in contributing to our current climate crisis. Therefore, as I am attempting to “write in dialogue with those who remind readers of unequal relations among humans, industrial ecologies, and human insignificance in the web of life” I will instead use the term “Capitalocene” (Gan et al. 2017:G3).

Focusing on human caused environmental change as a catalyst for our current ecological crisis requires us to go back much further historically, and to think critically about how our species exists in multi-species assemblages that defy simple categorization. Contemporary discussions of environment often focus on what Moore calls "humanity’s capacity to extract the ‘Four Cheaps’: food, energy, raw materials, and human life [labour]” (2016:11). My focus is specifically on the role of agriculture in discussions of ecology, multi-species assemblages, and the relationships in the web of life that have contributed to our current state of environmental crisis.

In this chapter I will explore, within the context of agriculture, some of the major historical transitions that have led to particular ways of relating within ecology and which have contributed to our current state of climate crisis. I include discussions of the Neolithic Revolution before discussing the “Age of Capital”, and then use the framework of “Food Regimes” (Friedmann and McMichael 1989) to discuss the role of agriculture in colonial expansion and industrialization. Each of these perspectives offer valuable insight into the origins of today’s crises. However, it is important to note that the complex relationships of humans and other species, of environmental transformation, of labour, of markets, of states and capital, are messy configurations. There are no beginnings and no

ends. It is impossible to establish the point at which our existence as a species became untenable. History is constructed with linear ideas of time and space, however the reality of existence and of relationships within ecology are much messier, more contested, more nuanced, and perhaps more hopeful. I will also introduce the voices of some of the farmers who took part in this research. Their narratives help to illuminate some of the challenges facing this particular group of farmers at the time of research.

2.1. Humanity *with* Earth

In order to understand the role of agriculture in relation to current climate and environmental concerns it is necessary to go back in history. Until very recently, history and anthropology, as academic disciplines, have been complicit in their singular focus on humanity without serious consideration of the complexity of our involvement with Earth's ecology and the fact that our survival is contingent upon our relationships with other species. Even our most recent discussions of the "Anthropocene" (Crutzen and Stoermer 2000) as a geological epoch named after "human-driven" environmental change perhaps unintentionally reinforces this ethic. This emphasis on *anthropos* is not inevitable and stands in contrast to history more broadly, as many Indigenous societies are not anthropocentric in their historical constructions of humanity (Sponsel 2014). By "anthropocentric" I am specifically referring to the elevation of humanity as the most important aspect of ecological relationships. While examining the bigger questions of "how did we get here?" I think it is necessary to reinforce the reality that our evolution as a species is not just a story of humanity, but a story of complex exchanges within Earth's ecology that continue to unfold.

The Earth is not a stage on which various species live. Our planet is constantly making and unmaking in concert with the multiplicity of lives that make up its ecology. In his description of "Gaia" originally published in the 1970s, James Lovelock (2000) forces us to confront the reality that Earth's climate and surface conditions are closely intertwined with the organisms that inhabit the planet. Earth, or "Gaia", is not a static condition, nor does it exist apart from its inclusion in the vast universe. It is time and

space, and none of these things, and everything all at once. It is both chaos and order, beauty and the beast. Lovelock attempts to describe this complexity:

> The nearest I can reach is to say that Gaia is an evolving system, a system made from all living things and their surface environment, the oceans, atmosphere, and crustal rocks, the two tightly coupled and indivisible. It is an "emergent domain"—a system that has emerged from the reciprocal evolution of organisms and their environment over the eons of life on Earth (2000:11).

Considering human history seriously then, requires us to contemplate our place in planetary history and the multitude of factors and relationships that have made our success as a species possible. Volcanism, tectonic shifts, changes in climate, and fluctuations in precipitation all created conditions in which humans and other species have had the ability to flourish. These ecological conditions were the result of universal and planetary changes that occurred over millennia and include relationships between the Earth and the various organisms that live here. I wish to acknowledge these processes and consider them seriously.

Humans, like any other species, change their environment. These dynamic processes take place within a context of multiplicity in which species relationships radically alter ecology, allowing some species to succeed at the expense of others.[6] Tobias Thornes describes it this way: "Earth is not only a static platform upon which life-forms develop, but rather a dynamic world in which life nourishes, adapts, and brings about changes that in turn influence the development of present and future organisms" (2016:82). Isotope analysis and the fossil record show evidence of these changes, including periods of extinction denoted by geologic intervals (Stanley 2016). However, many discussions of ecological change still make reference to the "physical environment" as if climate, precipitation, water, and soil, can be understood outside of their relationships with "living" species.

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[6]See Fetzen, et al. (2015) for a comprehensive discussion of ecosystem dynamics and the relationship of species functioning and biodiversity.

Making the shift to understanding humanity *with* Earth, as opposed to humanity *on* Earth is imperative. It requires us to challenge the notion of Earth as terra firma on which humans and other species play out their lives, and to embrace Earth as a set of complex interactions in which humanity plays a part. This requires us to engage critically with the idea that humans can be labelled either as destroyers or saviours, and to avoid adopting perspectives that reinforce the idea that the planet would return to an ecological balance if it were not for human behaviour. More recent work has critiqued the equilibrium model of ecology, engaging with research in positivist ecology that questions the idea that ecological systems return to a "benchmark" state (Zimmerer 2000).

Earth's ecology as a set of relationships offers new possibilities. Our current state of ecological and climate crisis has occurred as a result of particular relationships between humans and the rest of Earth's ecology. These processes of relating are not natural or inevitable, but have evolved out of complex processes throughout history. In examining these processes and considering them critically, we have the potential to disrupt our current trajectory and create new ways of relating that may mean a brighter future for us all.

2.2. The Neolithic Revolution

The Neolithic Revolution, sometimes referred to as the Agricultural Revolution, is the period of human history defined by a transition, in some parts of the world, from hunting and gathering to increased sedentism, reliance on agriculture, rapid population growth, and the development of states (Putterman 2007). Different biogeographic and climatic conditions in the Early Holocene period, which began approximately 12,000 years ago, resulted in differences in timing and transition to agriculture and animal husbandry (Lu et al. 2017; Putterman 2007). Despite the descriptor used to label this particular time period, it was not a revolution so much as part of the natural ebb and flow of human subsistence patterns. The transition to agriculture did not come suddenly, but happened over a ten thousand year period (Graeber and Wengrow 2018). These processes are commonly discussed within a human-centred paradigm of cultural and historical evolutionary

progress without consideration of the necessary ecological conditions that supported these processes. However, palaeoenvironmental and faunal analysis by archaeologists continue to expand our understandings to include the role of ecological change in human settlement and subsistence strategies (see Lu et al. 2017). Ecological pressures such as changes in climate and decreasing availability of big game animals likely contributed to the adoption of agriculture as a subsistence strategy. Conversely, the archaeological record and subsequent analysis suggests that this period resulted in plant and animal diversification, as well as human social, political, and economic changes that caused environmental degradation at various scales (Olofsson and Hickler 2008; see also Lu et al. 2017). Some economic scholars suggest that the Neolithic Revolution provided the foundation for future processes of industrialization and sustained economic growth (Weisdorf 2005), including the growth of cities, changes in labour relations (including slavery), politics, as well as new forms of knowledge and technologies.

My purpose in including the Neolithic in contemporary discussions of agriculture and climate change is twofold. The first is to acknowledge that agriculture was contingent upon thousands of years of atmospheric, climatic, and biogeographical changes within Earth's ecology that created the necessary conditions for agriculture to evolve as a subsistence strategy for humans. The second is to highlight the important role that agriculture has played in our current climatic and environmental crisis. This position modifies the arguments put forth in some of the literature that suggest our current state of ecological crisis is primarily the result of capitalism or the massive changes that have occurred as a result of the Industrial Revolution (see Moore 2015, 2016; Haraway 2015; Lindgaard 2015). Although the "Age of Capital" shaped relationships, values, and human interactions within ecology in very specific ways, the "Age of Capital" was made possible as a result of the transition to agriculture. Property enclosure, and the creation of surplus made possible the expansion of manufactured goods and increased trade, making conditions more hospitable for capitalist exploitation (see Sahlins 2008). We cannot pinpoint a certain moment in human history where we can lay blame. History is

contingent and processual. It is contingent not just on human activity, but on a confluence of factors and processes that are relational.

In his discussions of the role of capitalism in our current ecological crisis, Elmar Altvater (2016) differentiates between the changes that occurred during the Industrial Revolution and those that occurred during the Neolithic. While he acknowledges that "the Neolithic Revolution opened the path for a great progress of mankind, for the production of surplus, also for an increase of labour productivity", he argues that the use of solar energy during the Neolithic, versus the reliance on fossil fuels which characterize the Industrial Revolution, is an important difference as solar energy is renewable, while fossil fuels are consumptive (Altvater 2016:145-146). Although arguably less disruptive to Earth's ecology than the mining and burning of fossil fuels, agriculture is also an extractive industry. It relies on the composition and structure of the soil to nurture specific plant life. Like fossil fuels that have developed from complex geological and environmental processes, soil is the result of thousands of years of interactions between water, plant detritus, animal excrement and remains, minerals, microorganisms, bacteria, etc. Soil is highly responsive to its interactions with other ecological processes such as precipitation and wind. Its composition changes in response to vegetation, animal, and insect life. It is vulnerable to erosion and desertification. Soil is a finite resource and agriculture is consumptive in its capitalization of soil as a resource for cultivation. As Foster and Clark explain, "the extreme appropriation of the earth, in combination with the slave system, and imperialism, provided the wealth and raw materials spurring the development and expansion of industrial capitalism" (2018:16).

McNeill and Engelke (2014) similarly discuss anthropogenic environmental change within the context of what they describe as "The Great Acceleration," referring to the acceleration of energy use, population expansion, and greenhouse gas emissions as a result of fossil fuel extraction and consumption (primarily coal and oil) that have occurred over the past 300 years. Undoubtedly the changes that have occurred in Earth's ecology have accelerated as a result of the burning of fossil fuels, as well as many other social, political, economic, and ecological factors that have occurred post-

industrialization and during the "Age of Capital". What I wish to accomplish by including discussions of the Neolithic is to emphasize that we did not come to these systems accidentally, but as a result of processes and relationships that began long before our most recent history. While the role of capitalism as a mediating force has radically altered human relations with the planet's ecology and other species through sustained processes of exploitation and consumption, capitalism emerged out of historical systems of relations among humans and non-humans, with the planet, and through thousands of years of social, ecological, political and economic changes that were dynamic and contested. The Neolithic Revolution was an essential piece of the transformation that helped propel us towards modern capitalism.

2.3. The "Age of Capital"

The long sixteenth century, or what Moore (2016) describes as the "Age of Capital", can be seen as a catalyst of our current environmental and climatic crises, contingent upon the tens of thousands of years of biogeographical and human history that preceded it. Beginning in approximately 1450 CE and culminating in the neoliberal capitalism of the present day, massive changes in how humans relate to Earth's ecology and to one another have had an indelible impact on many species' ability to survive and thrive.

In Europe, the transition from feudalism to capitalism was predicated on the transformation of agriculture. Under feudalism, most farmers were self-sufficient, but as populations grew so did tenant farming and increasing demand for agricultural markets. Capitalism emerged through mercantilism (mid-fifteenth to mid-eighteenth centuries) —"a period dominated by expropriation under the hegemony of merchant capital, including robbery, enslavement, and the outright seizure of the title to real property" (Foster and Clark 2018:1). The enclosure of the commons and expropriation of the "natural world" through processes of capital accumulation imposed new forms of relations including the commercialization of the soil and the creation of the modern working class (Foster and Clark 2018:1). Marx (1970) defined the transformation of ecology under capitalism as the "metabolic rift" referring to the change in human

relationships to ecology through the alienation of farmers both from the soil and from the products of their labour. This culminated in new divisions of labour where local relations gave way to more globalized relations between the country and the city (Mark and Engels 1970:54–58). "In particular, the nutrient cycling of the old agrarian systems was disrupted as agricultural produce was increasingly directed to feed the surplus population, which now resided in increasingly distant locations" (Moore 2000:125). This disruption in the cycling of nutrients led to soil depletion which was addressed through expropriation of another form—the mining of nutrients to be used as fertilizer. As Marx envisioned it, the metabolic rift was a multi-scalar process with each subsequent ecological crisis addressed through the use of new technology as demanded under capitalist logic.

Jason Moore argues that each phase of world capitalist transformation is "at once cause and consequence of a fundamental reorganization of world ecology" and proposes a theoretical framework for understanding the relationship between nature and capital based on the concept of *systemic cycles of agroecological transformation* (2000:124). Using Marx's concept of metabolic rift and Wallerstein's vision of capitalism within World Systems Theory as starting points, Moore argues that "each new phase of capitalist development ushers in a new, more intensive and more globalized exploitation of nature by capital" (2000:137). He argues that the metabolic rift has been exacerbated by the "radical simplification of the natural ecological order" (see Worster 1990) as best represented by monocultural production (Moore 2000). The result has been not only a widening of the metabolic rift between town and country, but between country and country (Moore 2000:138). Moore describes the demands of capitalism and how the dependence on external resources and labour increases over time:

> …because of its metabolic rift, capitalism has been unable to sustain itself as a closed system, in which nutrients are recycled, but rather only as a flow system, requiring ever greater external inputs to survive. As a result, the system is compelled to seek out fresh land beyond its boundaries. Fresh land, however, is worthless without fresh labor. Consequently, each expansion of the world economy has been accompanied not only by an expansion of the system's potential natural resource base but also equally by a new phase of primitive accumulation, which is

> not only an economic and ecological process but also equally a moment of intense class struggle (2000:146).

Friedmann and McMichael (1989) provide further insight into these processes by examining the role of agriculture in processes of colonization and capitalist logic in a globalized political economy. Although devoid of critical engagement with the impacts of agriculture on ecology, "food regime" analysis attempts to explain the strategic role of agriculture and food in the development of the world capitalist economy and trajectory of the state system (Friedmann and McMichael 1989; McMichael 2009). Focusing on the political and economic structures that underlie relatively stable and distinct historical periods in the global food system, "food regime" analysis links international relations of food production and consumption to forms of accumulation and capitalist transformation (Friedmann and McMichael 1989:95). As a move away from more linear analyses of agricultural modernization (see Scott 2009; Weis 2007), the concept of "food regimes" offers "a more structured perspective of agriculture's role in capital accumulation across time and space" (McMichael 2009:140).

2.4. The "Colonial–Diasporic Food Regime"

The first food regime, referred to as the "Colonial-Diasporic Food Regime" (Friedmann 2005) was identified as taking place from about 1870–1917 and was characterized by free trade between European colonial powers and settler colonies under British hegemony (Friedmann 2005; McMichael 2009). A diaspora of commercial family farmers in the settler states (particularly Canada, the United States, Australia and Argentina) became the primary suppliers of wheat and meat which helped fuel the emerging industrial classes of Britain (Friedmann 1978; Friedmann and McMichael 1989; Weis 2007). The regime was characterized by two independent but mutually reinforcing processes: the development of independent nation–states and the industrialization of agriculture (Fairbairn 2010; Friedman and McMichael 1989). To emphasize the complex dynamics and contradictions that characterize particular food regimes, Friedmann and McMichael maintain that these regimes are always contested and that this ultimately produces crisis and transformation, eventually leading to a transition to successor regimes. Eventually, the rise of the nation-

state system would contribute to crisis, leading to the first food regime's ultimate demise (Friedmann and McMichael 1989). During the Great Depression and World War II eras, the collapse of the gold standard and free trade signalled the end of the first food regime and state regulation of markets became the new model (Friedmann and McMichael 1989).

2.5. The "Mercantile–Industrial Food Regime"

The crisis that characterized the period between regimes lasted for approximately 30 years before a new regime consolidated, this time under United States hegemony and based on state intervention rather than free markets (Friedmann 2005). Referred to as the "Mercantile–Industrial Food Regime", which evolved between 1947–1973, from the Marshall Plan[7] to the Green Revolution[8], this second food regime emerged as the decolonization process broke up colonial trading blocks and as newly emerging nation–states sought to establish national economies based on commodity relations (Friedmann and McMichael 1989:104). Relations of production and consumption were characterized by protectionist policies as nation-states followed the example set by the United States and instituted policies favouring protective tariffs, export subsidies, and domestic price supports for farmers (Friedmann and McMichael 1989:104). The result of subsidized agricultural production was chronic overproduction of grain leaving the United States government with the task of finding markets in which to dispose of surpluses (Friedmann and McMichael 1989; Friedmann 2005).

In developing nations, transformation of markets and diets came as the result of wheat exports being "dumped" under the guise of development aid, which had the advantage of fulfilling the U.S. need to find new markets for its surpluses while appearing to help new states seeking cheap food to help propel their own industrialization

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[7] The Marshall Plan was an American initiative to provide financial aid to Europe to help in their recovery after the devastation of World War II.

[8] The Green Revolution began in the mid-twentieth century and was characterized by the development of synthetic fertilizers and pesticides, as well as different cropping methods leading to higher yields and technology transfer to developing nations.

(Friedmann and McMichael 1989:104). Although many of these newly independent states welcomed U.S. wheat when it came in the guise of foreign aid, constant dumping led to a downward spiral in world prices, leading to imported wheat having a price advantage over domestic grains (Friedmann and McMichael 1989:104). This ultimately has led to the displacement of traditional foods as well as the proletarianization of farmers in developing nations (Friedmann 2005). Trade and aid policies further transformed agriculture to focus on export economies, contributing to malnutrition and rural poverty (e.g., growing cacao or sugarcane instead of vegetables) (Li 2014; Goodman and Redclift 1991). As the idea of development was internalized by so-called "Third World" states, land reform and a new division of labour began to consolidate around the adoption of national agro-industrialization and Green Revolution technologies, despite considerable peasant unrest (McMichael 2009). Meanwhile in more developed countries, the impetus towards Keynesian economics and Fordist production lead to relatively high wages for the working classes, supporting mass consumption of "value-added" foods (Friedmann and McMichael 1989; Goodman and Redclift 1991).

From a historical perspective of agrarian political economy, women's role was seen as pivotal in the transformation of labour characterized by contemporary capitalism in the form of Fordism. The transition of women's labour from the home to the workforce helped propel the demand for convenience foods and household implements (Goodman and Redclift 1991). These mutually reinforcing processes bolstered capitalist accumulation processes by propelling increasing demand for consumer goods. This allowed women to save time on food preparation, thus freeing women for other kinds of labour (including wage labour), leading to more income and purchasing power, and thus to more commodity fixation (Goodman and Redclift 1991). Agribusiness continued to establish transnational linkages between specialized farm sectors, creating global supply chains (McMichael 2009; Weis 2007) and leading to a new economic model based on transnational commodity complexes (Raynolds et al. 1993). Multi-national food processing, production, and distribution systems led to poor farm prices, at the same time

making it more expensive to purchase quality, healthy food (Goodman and Redclift 1991).

2.6. The "Corporate–Environmental Food Regime"

From the late 1980s to the present, a third, possibly emergent, food regime has continued to deepen these processes (McMichael 2009). It is in this current phase that Friedmann and McMichael diverge in their opinions of how to characterize the current status of agrarian political economy. Friedmann (2005) argues that a "corporate-environmental food regime" is emerging as agrofood corporations appropriate the demands of social movements (animal welfare, fair trade, environmental responsibility), leading to further commodification, marginalization of peasants, and a widening gap between the rich and the poor. Specifically, there are concerns that corporate interests have seized the opportunity to capitalize on consumers who attempt to act on their politics through their purchasing power. Large agrofood corporations have invested in organic production, buy and sell fair trade products, and engage in small acts of environmentalism or animal welfare in order to "green wash" their actual environmental impact. These practices serve to further entrench corporate interests in agriculture which stands in stark contrast to the original intent of many of these movements, which were largely intended to disrupt the domination of corporate interests in the food system. These processes are reinforced as the shift between public and private regulation intensifies, although Friedmann (2005) does argue that this new regime has not yet consolidated and faces increasing transformative pressure from social movements around the globe. McMichael (2009) has focused his more recent work on the politics of peasants in the Global South, harshly critical of the modernist, development paradigm that views peasants as "residual" and focusing on social movements such as "food sovereignty" which shift attention to the world's small farmers.

The impact of the concept of food regimes on the study of agrarian political economy is immense, spanning decades of research and influencing multiple disciplines including women's studies, economics, geography, development studies, and

anthropology. As food regime analysis is likely the most influential concept in understanding agrarian political economy (Bernstein 2015), an emphasis on economic restructuring and its impacts permeate the literature. The devastating effects of trade liberalization policies and corporate control over agriculture can be seen in the inability of smaller, polyculture farms to stay in farming and the emergence of startling inequality among peasant populations (see Escobar 2008; Fitting 2011; Li 2014). Expanding agribusiness and high technology agriculture have lead to massive debt loads for farmers, increasing their vulnerability as they get caught up in the system of upstream and downstream interventions (seeds, fertilizers, agrochemicals, machinery, distribution and marketing) (Patel 2009; Weis 2007). Development narratives have been implicated in exporting this idea of agricultural production across the globe and the consequences have been immense, including changes in land use, labour, and migration patterns (see Fitting 2011; Goodman and Watts 1994; Gupta 1998; Li 2014: Shiva 2013).

With changing economic systems comes social and cultural transformation. Changes in labour relations, whether they be gendered, individual or kinship-based, have had significant impacts on political and community relations (see Wiebe et al. 2011; Fitting 2011; Li 2014). Social changes in demography (rural to urban migration, for example), birth rates, and patterns of relations among kin, all have implications for rural communities. In developed nations, succession issues have surfaced as family farmers face the reality that their children may choose wage labour in urban environments rather than agriculture (Fisher and Burton 2014). Affordability of culturally appropriate and healthy food, both in developing nations and in highly developed countries, has also become a pressing issue. Economic restructuring and the transformation of polyculture agricultural systems to intensive monocultures have led to changes in diet, including increasing consumption of processed and convenience products with attendant nutritional and health implications for the growing population of undernourished and malnourished (Patel 2009).

2.7. Food Regimes and the History of Farming in Canada

The usefulness of food regimes as a method of analysis can be seen in an overview of the place of agriculture in the history of Canada and its development as a nation. Since colonization, agriculture has played an integral role in the development of Canada. During the "Colonial-Diasporic Regime", settlers were encouraged to emigrate from Europe, largely to southern Ontario and Quebec, by the large plots of land being made available. Like other colonies, governments sought to promote agricultural development to fuel industrial processes abroad and assert political sovereignty (Russell 2012; Weis 2007).

A unifying national policy was developed in 1879 in recognition of the importance of agriculture for both political and economic development. "The National Policy included tariff protection for domestic manufacturing interests, initiatives to attract immigrants to western Canada, and the construction of a transcontinental railway to move people and central Canadian manufactured goods into the prairie interior and grain and flour out to ocean ports" (Skogstad 2007:27). This expansionist phase, which lasted until the 1930s, gave rise to a nation with a more developed political community and increasing economic prosperity (Skogstad 2007:27).

From the 1930s to the end of the Second World War, the state's role in the agricultural sector increased, but only as it served the national interest (Skogstad 2007). Like other nation-states during the second food regime (Industrial–Mercantile), several important state interventions occurred during this time period. The first policy initiative was the creation of the Canadian Wheat Board (CWB). The CWB performed pricing and marketing functions, including transportation, grain handling and sales arrangements with growers (Boaitey 2013). Essentially, the CWB provided a relatively stable marketing and pricing system, decreasing the risk of market volatility and its impact on farmers. The second policy initiative was the introduction of price stabilization (i.e. Agriculture

Stabilization Act and Tripartite Stabilization Program[9]), as well as financial assistance to agricultural producers (i.e. Farm Income Protection Act, Gross Revenue Insurance Program, Crop Insurance and Agricultural Disaster Income Assistance) (Schmitz 2008; Skogstad 2007). These policy initiatives would shape the trajectory of agricultural policy in the coming decades in a way that would see increasing state intervention and the development of more nuanced programs and policies to meet the needs of both farmers and export markets.

As agriculture in Canada moved into the 1980s and into the emerging "corporate food regime" (McMichael 2009), changes in the global economic system created new challenges for both farmers and different levels of government. While the increasing emphasis on market orientation created enormous economic opportunity for some farmers, the current global food economy has threatened the livelihoods of many small and medium-scale producers (Desmarais 2007, Skogstad 2007, Weis 2007). While the effects of the newly emerging food regime are felt unevenly between developed and developing nations (with impacts felt much more acutely in developing nations), the negative impacts of agro-industrialization are creating rural crisis in Canada (Wiebe et al. 2011). The insistence on the benefits of free markets has led to increasing control of the food system by a small number of transnational corporations which are increasingly "controlling seeds, fertilizers, agro-chemicals and livestock antibiotics and compelling the standardization and industrialization of farming techniques" (Weis 2007:13). As Weis notes: "the 'double squeeze' of rising input costs and low and falling farm gate prices have reduced profits per unit area, producing serious scale and mechanization imperatives and making smaller holdings less viable-the proverbial pressure to 'get big or get out'" (2007:82). As these challenges continue to contour the agricultural system in Canada, policy-makers struggle to ensure that Canada can compete on the world market while facing unprecedented rural crisis at home.

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[9] The Agriculture Stabilization Act and Tripartite Stabilization Program each provided policy measures to provide a modicum of income protection for farmers in times of depressed markets.

Friedmann and McMichael ultimately advocate for relocalization with global coordination to combat the issues with food regimes (1987:114). However, there is a serious question as to whether a coherent national policy is even possible or desirable in the Canadian context, where provinces have considerable autonomy in program implementation. National farm organizations are weak in Canada, but this is offset by the strong alliances that provincial farm federations and provincially significant commodity organizations have forged with provincial governments (Skogstad 2007:29). Canadian organizations have the potential to gain from this diffusion of responsibility as provincial organizations can bring pressure upon provincial representatives in the federal cabinet and on federal civil servants in the field (Dawson 1967:454). Evidence of the effectiveness of these kinds of maneuvers can be seen in the ability of Ontario farmers to block the release of genetically modified alfalfa and their success in helping to secure legislation to severely curb the use of neonicotinoid insecticides (Government of Ontario 2019; CBC 2018).

Discussions of food regimes tend to fall back on polemics reifying the monolithic agroindustrial food complex and farm organizations as knowable segments of civil society whose intentions can be neatly categorized. If we move beyond these actualizations, a more nuanced and accurate picture emerges of the complexity of alliances, dependencies, and relationships that both inhibit and enable the global food system to flourish. Different government agencies can have opposing or divergent agendas based on the needs of their constituencies. Agricultural producers also have competing motivations, sometimes working at cross-purposes or creating strategic alliances when appropriate in order to gain further leverage with state bureaucracies. We cannot understand agricultural policy in Canada without examining the history of agrarian reform or how its current trajectory is shaped by both domestic and global forces, all of which are in constant flux. As Hanson suggests, “understanding the complexities of this system and its impacts requires a multiscalar view, for while the process is directed by and responsive to global and transnational political and economic dynamics, it is likewise shaped by national policies, and provincial and regional realities”

(2007:609). While food regime analysis cannot provide all the answers about the global food system, it is good to think with. The historical trajectory of agriculture in Canada fits very nicely into each of the successive regimes. However, the emphasis on historical trajectory and on specific nation states as hegemonic entities may gloss over some of the complexities of the process as it continually unfolds and is transformed, often in unexpected ways.

2.8. Current State of Farming in Canada

The transformation of agriculture, ecology, and capital discussed in the previous section has culminated in a global food system that presents unique opportunities and challenges for Ontario farmers. Often considered a model of high-technology and food system productivity, farmers here have widely embraced biotechnology, scientific research, and innovation. This has led to rapid changes in farming systems over the past several decades, some of which have increased productivity and profitability contributing to a robust Canadian agricultural sector, and others which have proven disastrous for both farmers and ecology. During my fieldwork, the farmers I spoke with discussed specific challenges they experienced while participating in the food system. I anticipated these challenges would coincide with distinct philosophies, political perspectives, and choices in farming methods. However, while there was individual variation and sometimes substantial differences in how farmers perceive, adapt to, and confront these challenges, most spoke very similarly about issues pertaining to ecology, society, politics, and economics, and how these intersect in complex ways for farmers.

My very first interview was with a conventional farmer. As my car pitched and rolled along a rutted county road in southwestern Ontario, I squinted to make out the numbers on the small blue flags that indicate rural addresses. Canada was in the midst of a federal election and overwhelmingly the signs that adorned the farms I passed were blue—indicating support for Stephen Harper and the Conservative Party. As I neared my destination, not only did the property indicate support for the Conservative party, but signs along the field facing the road indicated that this particular farmer was a seed

distributor for a major seed company—Pioneer. I was already a bit nervous as this was my first fieldwork interview, but these symbols increased my anticipation. I happen to lean very left wing politically and had decided on my research project because of strong feelings about the damage done to our food system and environment by corporations such as Pioneer. I had prepared a list of questions that I hoped to ask during the interview, but because of concern over potentially antagonizing this particular farmer, I decided to leave my questions in the car. This allowed the conversation to flow more organically and to my surprise, the encounter was not at all what I had anticipated. I was forced to confront my own preconceived notions about how narratives of sustainability in agriculture predispose those outside of it to see conventional farmers as part of the problem. My fieldwork revealed that this is a gross oversimplification. Many farmers who choose conventional methods do so as a result of complex systems and processes that reinforce this mode of production. Their participation in the system does not preclude resistance or critical engagement with the realities of being a part of that system.

Julie had long blonde hair and rosy cheeks, as if they had been perpetually kissed by the sun, cold, and wind. Her home was warm and welcoming and she offered me peppermint tea which I gratefully accepted. Julie began by telling me that she had grown up on a farm north of Toronto, married her husband John (who also came from a farming family), and relocated to southwestern Ontario where they farmed together. Despite being a conventional farmer and seed distributor and therefore complicit in the system of agriculture that is most concerning for environmentalists, Julie was very concerned about environmental issues and climate change, as well as the impact of certain approaches to farming on sustainability. She spoke frankly about the impacts of industrial monocultures on the environment and was a strong advocate of the idea that smaller, polyculture farms are more sustainable. She described the potential pitfalls of monoculture and failing to engage in crop rotation:

> In Chatham area even, there is big farming going on, cash cropping and guys growing beans, beans, beans. Beans for four or five years and the soil is turning white. You know? When we were smaller, mixed farmers, you did one year of corn and then you had a different grain crop on it, or you put it into alfalfa. Alfalfa

> nurtures the ground so much. Alfalfa is in there for three years and then you put it back into a grain crop. So you're doing what you need to, to keep things in balance. When things get big, things get out of balance. The bigger you are, the harder they fall and sometimes there's a lot to be said about that.

Julie appeared nostalgic about farming as it had been done when she was a child. She believed that many of the changes that have happened in recent years have made farming less viable both financially and ecologically. Drawing comparisons between the farm where she grew up and her experiences now, she illustrated how farming has changed within a few generations:

> Family farms have changed a lot and in my opinion it was a lot more wholesome when it was mixed farming. Ontario used to be, all around, was mixed farming. So it used to be you had 25, 50, or 100 chickens and you had some pigs and you had some cows, or you grew alfalfa and you grew corn and beans and wheat and oats. Or you had all of these different crops. And you crop rotated. You had your own manure and everything was easier to manage and control. Now everything is becoming bigger, bigger, bigger and it's managed differently and you have to move with it or you are not going to be able to survive. Great example of that is my dad came from a family of 10. They owned 22 acres, they had 200 chickens and they lived very well from that. He came to Canada. He bought 50 acres and we had, as children growing up, there was usually around 14 cows that were milked, and we had around 20 sows and sometimes we had chickens and sometimes we didn't. And we rented another 25 acres so we cropped around 75 acres of land. My dad raised 8 of us kids and he worked at General Motors to sustain it, and now John and I, we have this 200 acre farm and we have the one next door, so we own 400 acres and then we rent another roughly 500–600 acres every year depending on if you've lost it to a bigger guy who can pay more or whatever. And um, we have to have off farm income to make it work [pause] you have to unless you are in a situation where your great, great grandfather came to this country and he passed it down.

Julie's apparent concern about issues of ecology appear to stand in contrast to her participation in a conventional model of agriculture. However, the idea that conventional farmers do not care about ecology because they choose to use farming methods that are harmful to the environment is too simplistic of an analysis. Julie stated during this conversation that the current state of agriculture requires everything to become bigger and bigger and that "you have to move with it if you are going to be able to survive" which illustrates some of the pressures and constraints of farmers trying to survive in a system that favours large-scale and conventional farming methods. The conventional

model of agriculture has been widely embraced in Canada because it has specific advantages. Mechanization reduces the burden of physical labour, and high-yielding and genetically modified seed varieties have been heavily promoted as providing superior quality resulting in higher yields. The development of chemical fertilizers and pesticides have helped farmers deal with specific nutrient deficiencies and pest pressures. These benefits have led to an almost universal transition to conventional methods in southern Ontario.

Among the farmers that I met during my research there were many who expressed concern that our current food system is untenable. From an economic perspective, many farmers I spoke with struggled to make a decent living, often compete against their neighbours for quota and are burdened by massive debt. Julie was very frank about the financial pressures that she and her husband have faced. These financial burdens created the conditions whereby becoming a seed distributor was seen as a necessity rather than a choice. In fact, Julie suggested that working for Pioneer was a form of salvation as the income they derived from it saved their farm. I found this characterization interesting, especially after Julie described what I perceived as a predatory practice on behalf of the seed company. The representative made multiple visits to their farm to try and recruit them as seed distributors and then required adaptations be made to the farm infrastructure in order for them to get the contract. Despite this further financial burden, Julie and John believed Pioneer saved them from bankruptcy. I refer to this phenomenon as a kind of "Stockholm Syndrome"[10] whereby the same companies who have made the system untenable for many farmers are then seen as saviours when the income offered to farmers in exchange for their employment becomes the only thing that keeps a farm family afloat. Julie described it this way:

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[10] Stockholm syndrome is a term in psychology that refers to the condition whereby hostages develop an affinity for, or establish relationships with, their captors as a survival strategy. This term seems appropriate in this context as Julie was both critical of the agricultural system that has made it so difficult for farmers to survive financially, while at the same time praising the corporate agriculture company that hired her and her husband and being thankful for the opportunity as a means of ensuring the future viability of their farm business.

> John bought the farm and then interest rates went insane—25 percent. The first year we were married—we got married in 81—the first year we were married we paid almost $60,000 in interest to the bank on a $200,000 loan. So all through the 80s the interest rates were just so high and it was high for a long time. So it was really scary. So John had an off-farm job for part of it. He worked for Laidlaw cleaning portable toilets. I managed the farm here, and at the time, I had three children under five. They had to come to the barn with me. When my daughter was born, she was born at 2:30 in the morning and I was home at 3:00 in the afternoon and I was in the barn the next day. That was because you just couldn't afford any help. By 1990, we owed the banks $450,000, so we ended up taking a job from Pioneer. They came three times. We didn't know how we were going to do it. We didn't have any buildings to put anything. We had our pig barn and the garage had a little carriage house. It was just a little carriage house, it didn't even have a cement floor in it. We took on the position of Pioneer and I remember the Pioneer rep came here and he said "do you plan on putting a floor in here?" and I said "we will once we get paid by Pioneer", and then, taking in off-farm income and doing that job, being sales reps for Pioneer Hybrid Limited, that's what saved our behinds, otherwise we wouldn't be here anymore.

When I expressed dismay about the financial situation facing farmers, Julie laughed. She outlined the realities of farming in the face of increasing pressure to "get big or get out" (Weis 2007) and intimated that consumer expectations of cheap food contribute to the problem. She stated:

> Half a million dollars in debt. That's nothing. It's just bigger numbers. Farmers carry massive amounts of debt. Well you [pause] people will buy a $300,000 house in town you know. Well my $300,000 [pause] actually it won't buy much anymore (laughs), it used to buy [pause] well 30 years ago when we started it bought a hundred acres. Now I don't even think you could buy 50 for that. No you can't. Nope. You've got to double that number to buy 50 acres. At least. So yeah [pause] so you're still trying to make ends meet. You buy a 50 acre property or a hundred acres of farmland and you've got to pay a million and a half and you're still only going to make $30,000 or $40,000—where does the money come from to pay for that mortgage, right? And your tractor is worth about $100,000 and your combine is worth about $200,000–$300,000. My combine is a house on wheels. I remember when we started looking for a big one and he says "this is how much we're going to have to pay" and I says well, you better be willing to sleep in it! (Laughs) It's the game, it's an exciting game. It's just bigger numbers. We pay so little for our food. Because they think that everything should be cheaper than it is.

After this she sobered as she recalled the impact of these forces. She recalled how she and her husband struggled and how some close friends were not as fortunate:

> A lot of people who graduated with John at Ridgetown, and he graduated in ’79, um a lot of them lost their farms. There was a huge number, a high percentage of guys that year that lost everything that they started because they came into it at a very unstable time. All through the 80s the pig prices were depressed, beef went downhill and is still struggling. If you had quota you were very fortunate and were able to [pause] so feathers and milk is what kept food on the table for guys that were still in it. And we struggled and struggled and we just fought our way through and we made it.

I found Julie’s characterization of being fortunate in the face of such struggles as reinforcement of my understanding that farming is so much more than an economic enterprise. It is a way of life and one that is not given up easily despite the enormous workload and lack of financial incentive. Many farmers I spoke with had similar stories and would discuss the toll such an enormous financial burden can take. Most of the farmers in this study revealed they had never taken a real vacation. Even if they had family who could run the farm while they were gone, most simply could not afford it. One farmer I spoke with (also a conventional farmer) wanted desperately to modernize their kitchen, but the money simply wasn’t there. Like Julie and John, Helga and her husband William, conventional cash–crop and poultry farmers, expressed similar sentiments about the financial pressures that face farmers. Helga described it this way:

> A farmer in the 30s with a hundred acres would feed his family and a couple of other families. He made a good living. Now we would have to run 400 acres for the same standard of living. So you had to get bigger in order to do that. But in order for us to get bigger, you know, three other guys had to quit because they couldn’t make it on that hundred acres, right? And that hasn’t changed. In another 25 years you may have to run 1200 acres instead of 600, and you’ll still only make, say, $30,000, $40,000 maybe $50,000 a year. The same standard of living as if I lived in town to get a job and worked at 3M, General Motors, or Ford for example. Yeah, farmers don’t make that much money. So those who are committed to farming will get bigger one way or another, either by renting land from those who go to town and work and only derive part of their income from the land that they own. It’s a lifestyle thing—if a farmer has off-farm income it’s because he wants an off-farm lifestyle. I know this one farmer who got a job just so his wife could renovate the house, you know? And my brother too. His wife works because they had to fix the kitchen and the insurance wasn’t enough to fix it so she went back to work so they could fix it. So we’re rare in that neither of us has to go to work if we don’t want to. We don’t need off-farm income because our farm is big enough to do that. We work hard here though.

Despite these pressures, the farmers I spoke with showed an obvious affection for their livelihoods. William, a conventional farmer with an extremely large poultry farm (tens of thousands of birds) described how you live your work as a farmer:

> People go "Well it's a business", and it is, but it is so, so attached to everything else that you do. You can't separate it. Because I step out here—I'm there, right? You live your work. Whereas if I'm at GM, I wouldn't be there 24/7, I'd walk away at 5:00 and be home for say 13, 14, 15 hours and then I go back to work for 8. It's different. I'm here all the time. So if in the middle of the night, at 2:00 am if I wake up all of a sudden, well jeeze, what's that rattling out there? Oh, my feeders running empty. Well I better go out there and see what's going on. So you go out and you kick the feeder and it starts and it runs again. Or you have cows and you get up every two hours to watch cows calving. Or Lisa—she practically sleeps in the barn when her goats are kidding. Literally this summer there were like 42 goats ready to kid out in like 2 weeks. She literally slept in the barn because you have to make sure they come out good—but it's two weeks. You just do it (Laughs). You have your own work. What you do from 9 to 5 puts a roof over your head and food on the table. What you do before and after that makes you wealthy. Living makes you wealthy. It applies to everyone in town also. There's all kinds of opportunities there. They always keep coming.

I spoke with both conventional and organic farmers who also described distinct changes in the social structure of their communities. As a result of the decline in rural populations during the second half of the twentieth century as Ontario increasingly became a centre of urban industry, many communities saw the collapse of local businesses and rural infrastructure. The economic precarity caused by the treadmill of investment in upstream and downstream interventions (that were heavily promoted by government, industry, and in academic institutions) combined with low livestock and crop prices, caused many farmers to go bankrupt. Most were forced to sell their land. This land was often sold to neighbours who could not really afford the investment, but for whom the pressure to increase productivity meant enduring increased debt and workloads, or accepting the same fate as their neighbours. These pressures continue to place enormous burdens on farmers.

It was a hot and humid summer day when I visited Jack's farm. I was there to take part in a field day about farmers providing ecological services on their land. I was one of

the first to arrive and I started chatting with Jack—a heavyset man with a full beard and a stern expression. I explained a bit about my research and interest in the farming community and he explained that he produced sweet peppers (conventionally) for one of the national grocery chains. He had just received a letter in the mail that the company had decided to reduce the number of producers in order to "gain more uniform quality" for their consumers. Jack had been given the opportunity to increase his production by a substantial margin or lose his contract (and subsequently the main source of his livelihood). Jack explained that in order for him to increase his production by the amount required to maintain his contract, he would have to buy or rent even more land. He explained that he had lost many nights sleep trying to make a decision, but ultimately he felt he could not afford the financial burden of buying or renting more land. The labour requirements were a considerable deterrent as well. I asked him what he would do now, after deciding not to renew his contract. His attempt at positivity seemed a bit forced, but he had a smile on his face when he exclaimed: "I don't know how we'll make it, but we will. We always do".

As a result of these forces, farms continue to grow in size, further reducing rural populations and creating greater physical distance, as well as competition, among neighbours. Increasing debt loads and the burdens of labour lead to succession issues as sons and daughters abandon farming life for more lucrative opportunities in urban areas. Rising land prices have increasingly become a barrier for those who *do* want to farm (including immigrants) as even small farms are prohibitively expensive, creating a significant obstacle to the revival of rural communities. Although many farmers still have a strong sense of community and described being involved through churches, schools, and sports, even these connections are under duress. Some communities have seen school closures where populations had fallen precipitously and where they were close enough to larger towns and cities that their children could be bussed to urban schools.

The revival of rural communities as envisioned by many of the farmers I interviewed requires a return to the viability of smaller farms. A return to the land. This was seen as a responsible way of addressing the challenges of declining rural

communities as well as increasing environmental sustainability. Many of the farmers I spoke with, (both conventional and organic farmers), had concerns about land-grabbing and about the disconnect between farmers and urban consumers. There was a reification of the urban/rural divide which was interesting in light of the fact many farmers admitted having off-farm jobs, meaning that they themselves straddled this divide. Some argued that this distinction was much too simplistic as they were seeing a retreat back to rural living by many who made their livelihoods in the city. This pattern of urban exodus is being seen increasingly in rural areas outside of Ontario's largest urban centres as housing prices skyrocket. Those who seek home ownership make the decision to accept long commutes in exchange for home investment. These new rural inhabitants were often seen less favourably than farmers and other residents who had maintained rural residence over their lifetimes. Through my conversations with various farmers it became apparent that there was a great deal of concern about the purchase of highly productive land in order for it to be converted to housing developments, and resentment of the intrusion of "urban values" into rural spaces. Many farmers felt that their work and contributions were poorly understood and those that direct market sometimes had unpleasant experiences with consumers. Direct marketing refers to farmers who sell what they grow directly to consumers, typically either at the farm gate or at a farmers' market. One conventional farmer who used to sell at the farm gate on weekends decided not to do so anymore (despite the extra money it provided) because urban consumers would consistently argue and haggle to try and get their food at a cheaper price. She felt this was indicative of a lack of respect for the amount of labour and effort that farmers expend when trying to feed the rest of society. She explained that with the crops that were U-pick, consumers would overload their bags and baskets to the point she felt they were taking advantage and if she objected, they would discard their produce on the ground or argue with her. Another farmer (ecological) said she had noticed more "city people" in community spaces such as the local arena. She expressed feelings of community disruption, as in her small rural community most families knew and had connections with one another that created feelings of intimacy. Having strangers in their midst created a sense of discomfort that had little to do with the people themselves, but more to do with

what they represented. Lukas, an organic pig farmer, described the rural/urban divide in this way:

> Most people used to be related to a person who was farming, one way or the other. And you see that less and less now. And you get the urban issues versus the rural issues. They don't jibe anymore. Farmers like to use the urban/rural divide [pause] to their advantage. But I don't think it's really that way, because farmers have to see urban people as our consumers, right? So we have to appreciate that as well. And we need them as well, most of our food goes to the urban consumer.

Relationships matter. And considering how relationships are made sense of matters too. How farmers talked about their relationships with consumers and urban dwellers suggested some resentment—largely surrounding issues of entitlement by consumers, a perceived lack of respect, and a disconnect from the land. Community supported agriculture (CSA) projects work by connecting consumers directly with farmers and often involve consumers investing in seasonal subscriptions for the food being produced, which are then either picked up by the consumer of delivered by the farmer. While I was visiting Margaret, an organic farmer who runs a CSA program, she spoke about the relationship between larger societal structures within the food system by drawing connections between consumer behaviour, expectations of convenience, and the pressures on farmers to meet the demands of corporations. She explained how farmers like her attempt to both work within and subvert the system by offering things consumers have come to expect (like convenience and superior quality), while creating a degree of flexibility and autonomy for themselves through direct marketing and demanding fair prices:

> The grocery stores are so consolidated, they want one supplier and it's the whole system. It takes extra work and people don't want to work. They don't want to cook and they don't want to go out of their way. They just want to go to the store and get their food. As for me and my CSA, if they live within the town area that I service, I deliver it right to their house. I know that it's convenience and that's part of the reason people join, but at least its supporting the community.

Margaret's vision of environmentally sustainable agriculture is inextricably linked to discussions of community, financial security, and continuity. These are common discourses among the farmers with whom I work. Margaret described it this way:

> Well, I mean [pause] agriculture in general is not sustainable the way it is going, right? Sustainable has to be something that will last. Environmentally its got to last and you can't rely on bringing stuff in. It's got to last on its own. Agriculture that lasts also means community. You can't last if you're the only farmer left in the area, so there's a social side and a community side there too. And of course there's a financial side there too. Because of course you can't last if you can't survive. So you survive by subsisting on what you've got, but you can't do that totally so there's got to be some income and there's got to be a way [pause] to be sustainable there's got to be a way to have the farm continue after the current generations have gone. So you've got to be able to support the previous generation as well once they are no longer actively farming.

Robert, a dairy farmer who had once been conventional but had transitioned to organic for financial reasons, had similar views on the connections between community and environmental sustainability:

> Some of the things that I think about in agriculture [pause] you know it's funny, different policies and such, different countries [pause] the family farm is the best for society. The corporate farmer is the worst there is for society. Simply speaking [pause] corporations don't care about the environment. Or human health. Or the community. And that's simply put. I care about the community because I want the local school, I want the local plays, I'm involved in the softball team, I have an old age home potentially. You know? I'm involved. Corporations don't care. The owner will care about it to a point, but the men are just disposables. They're disposables. I don't look at my dad as being disposable. I don't look at my kids as being disposable. But in big corporations, they're a number. And you have to pay em. Big corporations are wrong in agriculture.

The farmers with whom I work often discussed how removed many of us are from the realities of food production. This disconnect further fuels the corporatization of agriculture. As William, a conventional poultry farmer, put it:

> Consumers are very [pause] sometimes have stupid ideas that are trying to drive the market. It wasn't like that when we were kids. The consumers are trying to drive what the demands are. Sometimes consumers are making demands that are unrealistic too. Like stupid commercials from Loblaws saying "we raise our pork

> products without the use of antibiotics". Nobody does in Canada! They make it sound like they are doing this noble thing when every pork on the shelf is exactly the same! So consumers get a misguided notion of what happens and what doesn't happen. Now that doesn't mean there aren't people out there cheating. Or bending the rules, or doing what they're not supposed to. You always get the extremes. You get extremes on the one side saying we only want organic, but don't want to pay a premium for it, and on the other side we can't accommodate that at the prices that you are willing to pay. Everybody votes every day when they go to the Superstore. They have to choose between $2.50 for a head of lettuce or $1.50 for a head of lettuce. The difference is the $1.50 one came from a farm that was conventional and the $2.50 one came from an organic farm. The majority choose the $1.50 one. If the majority chose the $2.50 one, the $1.50 one would quit doing what they were doing. Everyone would go organic. That's how the vote works. It always comes down to where you spend your dollar. People complain so much about their food, but they don't understand how their food works in their body either. They'll say, "well I need to buy good pork or beef," but then they don't bother to buy good vegetables. They don't buy any vegetables! Consumers know what they're told.

Margaret, the CSA farmer introduced above, expanded on the connection between consumers and what is often discussed as "value added" in the middle of the corporate food system—i.e., all of the companies that capitalize on the labour of farmers and add value through packaging, processing, shipping, etc. These are the forces that ultimately change raw food into commodities through processes that contribute to the disconnect between farm and table, put pressure on the system to keep costs low, and contribute to health and environmental problems. Margaret described these processes and their impacts:

> It's consumers, but it's also who else is making a lot of money off of agriculture. Whether it's the input suppliers, or the processors or the retailers, I mean [pause] and of course that goes back to consumers who own shares (laughs) in those companies, or have jobs doing who knows what? They're consolidating and they're taking more power. And it's also this idea that you have to keep getting bigger and bigger and bigger and I find it really odd [pause] the farm organizations and the farmers that talk about how you need to get bigger and then in the next breath they talk about how "isn't it too bad there's no young farmers?" Well, where did you leave a space for them? If you just bought up the next farm, where did you leave a space? So you can't have [pause] as long as we're going to get bigger and bigger, the less people we are going to need farming. I think to be sustainable in the long run, you need to bring more people back onto farms which means more people

> farming in a different way. It means farming with people power more so than with chemicals or pesticides or whatever.

Throughout my fieldwork it became apparent that for the farmers I spoke with, enhancing resiliency to climate change is exceedingly complex. Discussions of environmental sustainability and climate change could not be understood without engaging with the distinct social, political, and economic challenges facing farmers. The reality for these particular farmers is that climate change is both hypothetical and undeniably concrete. It is hypothetical in that many of the farmers with whom I work have yet to find their farming systems adversely affected by changes in temperature or precipitation. They have not yet been affected by an increase in adverse weather events. In fact, the past several years (2014-2018) have been "good years" according to the farmers I have spoken with. They have yet to experience any of the dire predictions of scientists. However, the spectre of climate change and of the need to change our relationship to the rest of ecology manifests in other ways for farmers, and this has enormous implications for them in terms of identity and their choice of farming methods.

2.9. Farming Methods

Climate change may not currently present significant ecological challenges for southern Ontario farmers, however it is a social reality that presents itself in complex ways. The optics surrounding issues of sustainability create social and political pressures on farmers to modify their growing practices. Global awareness of the issues surrounding climate change and environmental devastation are shaping government policy. Countries importing agricultural goods from Canada are increasingly asking for sustainability certification, with threats to import food from elsewhere if Canadian farmers and policy makers do not conform. Changes in government within Canada, at both the federal and provincial levels, shape the policy landscape in ways that ultimately affect the ways farmers approach their businesses. For the farmers who direct market their food, either through farmers' markets or CSAs, there is even more pressure to conform to societal pressures regarding sustainability and environmental responsibility. This is largely due to consumers who believe buying local and direct from farm to table, helps contribute to

environmentally responsible consumerism. These pressures are in addition to those that already exist in a food system controlled by a few large multinationals who shape everything from trade agreements to food policy.

At a 2017 annual meeting for the National Farmers Union of Ontario, a farmer who described himself as very concerned about the environment explained how he had been verbally attacked at the farmers' market. He was there to direct market his grass-fed beef. This farmer described his products as "local", "natural", and "healthy" and was proud of the humane way in which he treats his animals. Yet a customer at the farmers market berated him for his choice to engage in animal husbandry and said that his cows were doing more harm to the environment than his own decision to drive a large SUV. The farmer's reaction was one of confusion. Was this true? While he attempted to defend his environmental footprint, or "hoof print" as it were, the SUV–driving gentleman walked away. The confrontation had left the farmer feeling confused and seeking answers. This is just one of several anecdotes I have heard in which farmers who engage directly with consumers have had to defend their production methods in relation to their environmental impacts. For this farmer, accusations that his methane producing bovines were more detrimental to the environment than a fleet of SUV driving executives, left him baffled and seeking answers. Heather Paxson, who conducted research among artisanal cheese makers in the United States, similarly found that moral criticism is a common feature of contemporary food politics. Speaking of a Vermont dairy farmer's experiences at a farm open house, she told of how the farmer "had to defend nearly all her farming practices to an audience that, despite its appreciation of the product of her labour, second-guessed her at every turn" (2013:93). Paxson explains that "while the audience spoke in terms of normative standards for what they imagined as 'good' agricultural practice, the farmer grounded her moral decisions in the specific, productive ecologies of her farm" (Paxson 2013:93). As the issues that surround the industrialization of agriculture permeate public consciousness, farmers are being called upon to perform care in ways that alleviate concerns about the ecological and animal welfare aspects of agricultural production.

Increasing consumer consciousness and demand for locally produced, environmentally sustainable food has forced issues surrounding climate change and environmental sustainability into the forefront of agricultural production in southern Ontario. For farmers who direct market their produce, this is certainly not a new phenomenon, but as the example of the grass-fed beef producer shows, even farmers once considered pioneers in their commitment to environmentally sustainable and humane methods are now being forced to further consider their carbon footprint.

Many conventional farmers whose farming systems rely heavily on chemical inputs in the forms of fertilizers and pesticides, have largely ignored the increasing call for environmentally sustainable and climate-smart agriculture, as evidenced by the fact that ecological and organic farmers are such a marginal group (approximately 2%) among Ontario producers. However, the ability to ignore the ecological impacts of conventional agriculture is becoming increasingly difficult. According to a representative from the Ontario Ministry of Agriculture and Rural Affairs (OMAFRA) under Kathleen Wynne who I saw speak at a conference sponsored by the Ontario Federation of Agriculture in 2016, many export markets, such as the vital European market, are putting pressure on the Canadian government to improve production standards and will soon require sustainability certification for many imports. Ontario farmers are now facing pressure to comply with global sustainable crop production standards and practices. The OMAFRA representative spoke about the government's commitment to fighting climate change and their focus on innovation in agriculture to increase environmental sustainability. She stressed that farmers are being pressured to continuously improve sustainable production practices or risk losing market share to other countries such as the United States who have better programs in place.

At a recent Farmstart conference sponsored by the Ontario Federation of Agriculture (Canada's largest farm organization), the theme that permeated many of the sessions was environmental sustainability, agroecology, and climate-smart agriculture. As this is the farm organization that tends to primarily reflect conventional farmers and agribusiness, I was very surprised by what I witnessed at the conference. Attendees were

told that over the past 2 years the conversation surrounding agriculture had changed, from focusing primarily on the economy to emphasis on the environment and climate change. You could see this reflected in the conference panels. There were sessions with titles such as “Sustainable Livestock Need Sustainable Crops”, “Livestock Operations Rooted in Sustainable Agronomics”, “Sustainability in the Agri-Food Sector”. Farmers were encouraged to diversify production and use polyculture farming practices, reduce their livestock footprint, employ crop rotation, and use cover crops. After decades of promoting a system in which farmers have been encouraged to specialize and get bigger to be profitable, larger farms were now being discussed as being more fragile and vulnerable to damage caused by storms or disease. Farmers were encouraged to use the sustainability narrative to build public trust, and in some cases even to maintain market access. They were encouraged to re-connect with their communities to try and combat some of the “big is bad” consumer perceptions. Many of the attendees at the conference seemed baffled by the messages they were receiving. Some of the questions that came from the audience during the panels were: “So you mean after years of you telling us we should specialize, now you are telling us to go back to mixed-farming like our fathers did?” The answer to this question was “yes, mixed farming models work best. Big systems are efficient but catastrophic when they fail. A more complex system equals more productivity and is more sustainable”. Some other questions were: “What will consumers expect from us in the future? What do we need to be prepared for?” The answer was that farmers need to be doing more work to address the needs of the environment. The end goal needs to be balancing agronomics and economics with consumer and societal demands.

For many of the farmers I spoke with at the conference, the issue of climate change and environmental sustainability had suddenly been made real in ways it hadn’t been before. They were forced to consider not just new government policy aimed at increasing environmental sustainability, but the reality that previously profitable markets may soon disappear if changes are not made to make Ontario agriculture more sustainable. Issues surrounding public image as well as social and consumer acceptance

were discussed in the context of farmers having to adapt to new circumstances and public scrutiny. In this context, farmers were encouraged to adapt and innovate. This was confusing for many farmers who take part in a system that still heavily favours industrialization and conventional production methods. Many of these farmers had attended college or university where the programs promote the conventional model of investment in chemical fertilizers and pesticides, and where the goal is high yields and profits without serious consideration of the impacts of these practices. In fact, many of the farmers I spoke with told me that during their education, questions they would ask about organic or ecological methods were often dismissed. Elias, a dairy farmer who had transitioned to organic after having been conventional for many years, explained how conventional models were touted as the only viable means of production during his education in the 1970s:

> Well, when I went to school the teacher told us, "If you don't use fertilizer you are a stupid farmer". He put it up on the blackboard, how much you'd save and how much your yield will increase and at that time he only talked phosphorous, potash, nitrogen [pause] if you've got those three things, everything grows.

Henrik, a young farmer who had grown up on a conventional farm but is now a successful organic farmer, expressed his disenchantment with the system. He described his frustration with the education he received in the agriculture program at the University of Guelph in the 1990s:

> When I was at Guelph, I saw a movie in class about how organic farmers went broke. But in Guelph, if you look at the concepts they teach, some can be applied to organic. But they don't teach organic at all. I think it's because a lot of universities and colleges are not publicly funded anymore, so they have to find private funding and the private funding is of course [pause] is mostly large corporate ag that tells you to "Here try this seed variety, try this herbicide", you know? Because that's the kind of trials they do now. You know?

Henrik acknowledged that although some things have changed for the better, he still feels that there is a lack of opportunity to learn about organic agriculture and that universities and colleges appear unwilling to address the issue. He revealed that he had been asked to teach at Ridgetown (a campus of the University of Guelph which specializes in

agricultural programming). He was concerned that the university did not take organic agriculture seriously enough to invest in hiring qualified professors to teach it.

> At the colleges, they call me to teach classes and stuff because they don't have anyone at the colleges who knows anything or can teach about organic agriculture. I never have time to do it, but they always find some farmer or some relative of an organic farmer that will teach the course.

Farmers in southern Ontario also must face the realities of climate change socially. Climate change is a prominent issue. It is on the minds of consumers, of activists, of the media, and of politicians. Early adopters and ecologically-minded farmers have been riding the wave and have continued to adapt and innovate by changing their farming systems to organic, or marketing their production as "ecological" or "natural". Right now this strategy is profitable as a certain segment of consumers choose to make food choices that align with their politics. Other farmers are diversifying their production, creating new markets, or marketing specialty or heirloom products. Some are opening their farms to the community, trying to re-connect people to farmers and the food that they produce. Ultimately, each farmer is tasked with navigating the narratives surrounding sustainable agriculture and constructing an image of themselves in opposition to negative public perceptions that identify farmers as being directly responsible for ecological devastation (Harris and Bailey 2002).

2.10. Constructing "Good Farmer" Identity

When it comes to decision-making about how to grow and market the products of their labour, farmers are constrained by the system in which they work. My experience speaking with farmers in southern Ontario is that they are highly political. They have to be. Their livelihoods are heavily legislated and they face scrutiny from society and multiple levels of government on issues like land use, water resources, crop and livestock issues, the environment, wildlife conservation, farm safety, and employment issues. This is in addition to the pressures they face to produce food for specific markets. As a result, farmer identity becomes a performance of their choices and politics as they navigate these systems. Bourdieu, based on research conducted among

French farmers, discusses the challenges farmers sometimes face in shaping their own identity as agriculture remains a constant in the social imaginary. He describes farmers as an "objectified social class," or "a social class dispossessed of its power to define its own identity" (1977:3). In the context of southern Ontario, farmers are often prescribed one of two distinct identities: the farmer who tends to his crops and animals with a reverence for tradition and affinity for the land; or the farmer who has embraced an agribusiness/high technology model of agriculture. This is a false dichotomy to be sure, as many farmers straddle these distinctions, but farmers themselves have particular understandings about what being a "good farmer" means and will often leverage these identities in complex ways.

Identity is performative. For some growers, being a "good farmer" means incorporating mechanization, biotechnology and science, and enhancing productivity through high-input/high-output production systems in order to feed a growing world population (McGuire et al. 2012:57). For other farmers, "good farmer" identity means embracing their role as stewards of the land and recognizing their responsibility in addressing the environmental concerns surrounding agriculture (McGuire et al. 2012:57). However, the navigation of these contingent and sometimes conflicting roles reveals unique challenges. As was revealed in the previous section, farmers are heavily constrained by the system in which they work. However, participation in the conventional system of chemical inputs and higher productivity does not necessarily preclude a commitment to environmental stewardship and concern for the ecological effects of these production methods. Nor does participation in organic or ecological agriculture necessarily equate to environmentally responsible agriculture or negate the potential for participation in a global food economy based on exports, which substantially increases the carbon footprint of production. For example, Julie, who produces conventionally, showed a great deal of commitment to environmental stewardship and described doing what she could to foster ecological communities on her farm. Her concern over pesticide use had caused her to seek out environmentally friendly alternatives. She described buying essential oils and using them on her vegetables. However, constrained by finances

as she was, she could not commit to transitioning to environmentally sensitive alternatives for the bulk of her farm production:

> So if I'm growing my own garden, I can keep a healthy garden if I spray this on there. It protects it from fungus and mold. It's all natural and you could even drink it if you have any infection or anything going on and you rinse with it. So (pause) if I use it to clean the aluminum siding I don't get green fungi growing on there anymore. So there are things out there, but it's costly. So to do that over 50 acres is way too much money. So let's do it on the cucumbers and see how it works.

In contrast, Lukas, an organic pig farmer, raises his animals for export to China. Although he is strongly committed to environmental stewardship and maintaining the ecological health of the planet, in order to maintain the viability of his business he has capitalized on access to export markets. His willingness to send his animals to the other side of the world stands in stark contrast to his commitments to environmental justice as "food miles" contribute greatly to a farm's environmental impact. Although Lukas grew up on a conventional farm and his father still farms conventionally, he strongly believes in the principles of agroecology and the benefits of farming using these principles. He describes his thought process in choosing to produce organically:

> Farmers also have to realize we have other options. If they don't like the way the system is, they don't have to do it. But most people don't want to change. It's more work, but if you look at it, you're probably doing just as much work as a conventional farmer with three times as much acreage. But you are doing it with less risk, because you are working less land and have to buy less stuff. You are using smaller, so everything is cheaper. It's a lower risk way of farming than going big and conventional. I farm conventionally too—my dads farm, I farm conventionally so [pause] I kind of see both sides of it. Ah man, the amount of money going into that is incredible. The amount of the bills coming in from the input suppliers. And then you have to pay everything back, the stuff that you sell [pause] there's really not that much left over. So you see why farmers have to be so big—because the profit margins are so small. So it's kind of like a treadmill.

Lukas actively leverages sustainability narratives and the benefits of small-scale agriculture not only because he believes in these ideals at a philosophical level, but also because it is profitable. He carefully navigates between what he believes to be right as he establishes his own "good farmer" identity, but he is also constrained by what is practical

and profitable during a time when being a farmer is incredibly risky. Like many of us, Lukas lives his politics to the best of his ability within the constraints of larger societal forces. Ultimately, Lukas has a young family and has to make a living. This requires him to make trade-offs or sacrifice some aspects of his politics in order to survive.

Albert, an organic dairy farmer, admitted that the only reason he transitioned to organic was because he had a catastrophic event due to conventional practices and he was wanting the higher prices of organic in order to increase the likelihood his farm would survive. He describes what happened:

> I was using Roundup ready corn. I was one of the leaders in the field and I was getting massive yields. I put it in a silo and I got massive toxins in the silo, so all my cows are infested with massive toxins for two years. And out of that I automatically had a 30 percent reduction in production and all the cows livers were shot, okay? They couldn't reproduce. They had massive abortions, poor production and I had no choice [pause]. I basically had every cows liver in my herd was shot [the cows livers had become diseased due to exposure to high levels of toxins through their feed]. That basically wiped out my dairy herd and because their immune system was so violently stressed, I had a virus come through the farm that caused [pause] I had 80% cattle death because of it. So any heifer I did manage to get ahead of it [pause] there was a couple-but I had an 80–90 percent death rate. That was the time period where I switched. I didn't switch because of that, okay? I switched because of economic reasons. Now at one point I lost $100,000 dollars during the worst of it. The only reason I survived was because I was ready to build. I had money set aside, I had labour set aside, I had resources set aside to build a big dairy barn. And at the last second I stopped. Had I built the barn, I probably would have went bankrupt. I can say, when I went into organic I was scared shitless about the fact that I was going to have massive weed problems, massive mastitis problems, and massive disease pressure problems, and I was going to lose everything.

Although Albert only transitioned to organic agriculture to capitalize on higher prices, he reproduces many of the same narratives as other farmers I spoke with who advocate alternative forms of agriculture. He admits previously being a leader in conventional agriculture and getting massive yields, but also spoke very freely about his belief that conventional methods are unsustainable. He pointed to the lack of resilience in monoculture and stated "If a major event happens, how do people survive?" He argued that relying on corn and soy to feed the world was foolhardy and maintained that "small-

scale farms, polyculture farms, offer resilience and are profitable". He reinforced his own "good farmer" identity by suggesting the "only ones bucking the system are small oddballs like me".

Jack, the conventional farmer who had recently refused to renegotiate his contact with a large grocery conglomerate, is a proud conventional farmer. He believes strongly in the ability of science and technology to help navigate the world in a time of environmental crisis. Yet, for Jack, "good farmer" identity also means a strong affinity for the other species with whom we share the planet. Jack had recently signed up to transition some of his land out of productivity in order to create a wetland habitat. This kind of transition is often referred to as an "ecosystem service" and there are government subsidies that encourage this kind of stewardship. Jack mentioned arguing with his father about taking land out of production. In a time of economic precarity, Jack's father thought his son's decision lacked foresight. However, Jack explained his decision within the context of what farming meant to him and also that he would take joy in the wildlife that would be welcomed into the space. For Jack, farming was inextricably linked to memory and his fondest memories as a child were spent at a neighbouring farm catching frogs in the pond with his friend. He hoped to recapture some of that joy through his commitment to restoring wetland habitat on his land.

As climate change gains greater salience among consumers and politicians, farmers must increasingly navigate complicated and sometimes conflicting roles as business owners, family members, food producers, and environmental stewards. They must balance economic viability with their own politics and these can sometimes be at odds. In some cases, farmers take financial risks in order to live their own version of "good farmer" identity, abandoning their familial roots and education in conventional agriculture to pursue potentially more profitable practices such as organic, or to grow based on their own philosophy of sustainability using ecological or biodynamic[11]

[11] Biodynamic agriculture moves beyond the principles of organic agriculture (avoiding the use of GMOs, chemical fertilizers and pesticides, growth hormones, etc), to consider relationships within ecology and actively attempt to enhance the soil while also taking into account natural cycles. Biodynamic agriculture moves beyond ideas of mitigating the impacts of agriculture and is regenerative.

principles. For others, increasing investment in high-technology agriculture, despite the financial and ecological burdens, means the maintenance of a "good farmer" identity based on science and the hope that higher yields will ensure the viability of their farm in the future.

2.11. Sustainable Agriculture

The debate surrounding which forms of agriculture are considered "sustainable" often relies on narratives concerning biodiversity conservation, adaptation, and resilience. Discussions of sustainability in agriculture can be contentious among farmers and some of this tension has arisen because of very different interpretations of what these concepts mean. The farmers with whom I work are acutely aware of their relationships with other species and of the complex processes and interactions that are critical in the food web. Adaptation is necessary for farmers to be able to cope with changing soil conditions, adjust to changes in climate, and deal with the volatile economic situation. For many of the farmers I spoke with, adaptive capacity is limited if other species are not allowed to flourish. When discussing issues of sustainability, the farmers in this study were very consistent in their beliefs that the maintenance of biodiversity was important. Where they diverged was the perceptions each had about the impact of their own farming practices on biodiversity conservation and how they integrated discussions of sustainability into their perspectives about what it means to be a "good farmer". This was evident in the battle over neonicotinoid pesticide use.

Neonicotinoids are a class of pesticides made of synthetic compounds that are similar to nicotine and which target specific insect neural receptors (Millar and Denholm 2007). This pesticide, which is delivered through insecticide treated seed coatings, is of particular concern in issues of pollinator health as potential exposure can result from the distribution that occurs throughout the plant, including the pollen and nectar (Fairbrother et al. 2014:722). There is not enough documentation to definitively prove that neonicotinoid toxicity is directly related to increases in bee deaths, however there is mounting evidence to suggest that exposure to neonicotinoids may be implicated in

weakening honeybees and making them more susceptible to other pressures such as disease, cold, and nutritional stress (Fairbrother et al. 2014:722).

Fruit growers and farmers who cultivate vegetable crops have become increasingly concerned about pollinator health and have lobbied heavily for a ban on neonicotinoid use. This is largely because their crops rely on pollinators. Although some of the farmers I spoke with had their own beehives and had experienced colony loss, none of them had experienced any reduction in yields as a result of declines in pollinator population. This did not diminish the urgency of the issue for those farmers. For many, the debate over neonicotinoids is just one issue in the struggle over how we should grow food. For ecologically-minded farmers—by which I mean those who choose not to use chemical inputs in their production due to their concern about the land and their relationship with other species—there is a strong sense that we are headed in the wrong direction. There is definitely a divide between some conventional farmers and ecologically-minded farmers that has played out in politics in recent years in debates over genetic modification, pesticide use, and environmental stewardship. This divide among farmers over what is considered "sustainable agriculture" manifested in the debate over neonicotinoids. The tension could be seen in a number of my discussions with farmers:

> Well I'd like to see neonicotinoid seed treatments banned. (Laughs) I mean as a starting point. Neonics in general need to go, but to start, seed treatments need to go. I mean, It's absurd [pause] it's kind of telling to me, you know [pause] within a pretty short time, because they weren't approved until about 2000 as a seed treatment in corn and that was the first [pause]. We've gone from not using them at all as seed treatments, to 99 percent of corn being treated with neonicotinoids—with an insecticide. And then we don't even need it in most cases. So we've made the chemical companies a lot of money on prophylactic use of an insecticide and we're destroying the environment while we do it. I mean, it's absurd, from an environmentalist sort of point of view (laughs). (Market Gardener—vegetables, certified organic)

> No one can deny what's happening. The bees are dying. I know locally that none of our beekeepers have any bees right now. There is more and more evidence now, like at the college too, they are admitting that the bee community is being decreased by all these farm chemicals being used, especially the neonics's and fungicides that

> are being sprayed more than ever on crops. The bees don't stand a chance. (Pork farmer—certified organic)
>
> What conventional farming doesn't admit, is if you look at the bee deaths they still do not want to believe that they are causing the problem. For two or three more bushels of corn. It's not worth it. (Dairy farmer—certified organic, used to farm conventionally).
>
> It's a huge battle right now. It really is the chemical companies and the farm organizations that protect them and the farmers that believe the line they're given. It's really a lot of money going into lobbying so that there is no restriction on their use, but it really comes down to: are we going to do something right for the environment or are we going to do the bidding of the chemical companies? It's a bitter battle in the farming community. For most cash crop farmers, bees are not important. They are not necessary for pollination. (CSA Farmer—organic).

On the other side of the debate are the agribusiness companies who stand to lose a lot of revenue if they can no longer sell their products. The Grain Growers of Ontario and other like-minded farmers also want to retain the right to use neonicotinoids to protect their crops from insect infestations. Neonicotinoids are most commonly used on cash crops such as corn, soybeans, and canola. As these crops are self-pollinating, they do not rely on insects such as bees for their production. Those who are arguing against a ban maintain that neonicotinoids are the best option among available pesticides. As one of my contributors stated:

> Right now we put a neonic on soybeans—what it does is it controls soybean leaf beetles. If we don't put it on and we get leaf beetles in, then I go out and I spray with Matador which kills *all* the bugs out there. (Conventional poultry and cash crop farmer).

This farmer expressed frustration with the debate over neonicotinoid use as he felt he was using the most insect-friendly product available on the market. Although actively arguing against the ban on neonicotinoids, many of the conventional farmers I spoke with who used these pesticides expressed concern over the health of pollinators and acknowledged the contribution of beneficial insects to the farming system. They truly believed that they were choosing sustainable options among the pesticides available to them. Their decision to use neonicotinoids and to fight the ban was propelled by other factors than a lack of

concern over the plight of pollinators. Most often economic concerns were cited and many of these farmers felt they were doing the best they could, but felt they had a lack of viable options when faced with insect infestations that could potentially ruin valuable crops.

In the debate over neonoicotinoid use, the honey bee became symbolic of larger concerns about the impacts of industrial agriculture on ecology and the livelihoods of farmers. Many of the farmers who I met through my fieldwork and who choose methods that are outside of the conventional model have been persistent in raising issues of ecological concern, including lobbying the government and helping to raise public awareness of these issues. This particular type of activism appears much more practical than philosophical as there are very real implications for the livelihoods of farmers. Profit margins are extremely narrow in farming and the loss of pollinators could have devastating effects on those farmers who rely on pollinators for their crop production. Farmers who consider themselves in opposition to the dominant model are also strategic in leveraging narratives surrounding ecology, sustainability, and biodiversity in ways that capture the attention of consumers who are willing to spend money to support their politics.

In discussions over the use of neonicotioids, narratives surrounding the importance of "biodiversity" were used extensively. Biodiversity and resilience to climate change are closely linked. For the purposes of this dissertation I have adopted the definition which specifies biodiversity as a biological concept at genetic, species, and ecosystem levels (Bunce et al. 2012:19). However, biodiversity is a multifaceted concept imbued with biological, social, and political meaning. The critical theory surrounding the concept of biodiversity is insightful and provides important critiques of the exploitation of environmental crises as a means of further capitalist exploitation (Buscher et al. 2012:7). These discussions can be useful for interrogating how farmers leverage narratives of "biodiversity" and "sustainability" in order to access markets. However, understanding biodiversity as a biological concept is extremely important in the context of understanding vulnerabilities in a changing climate. The adaptive capacity conferred

by genetic diversity is an essential component to increasing resilience. Changes in climate, loss of habitat, and environmental pollution have an enormous impact on the ability of species to survive. The greater genetic diversification within a population, the more likely there will be some individuals with the characteristics needed for the species to survive. As all species are interconnected through the complexities of ecology and the food web, the loss of any species has reverberations throughout ecology.

During discussions of biodiversity with ecological farmers there was considerable emphasis on the need to renew the processes of seed saving. In previous generations, all farmers saved the seeds of their best plants to use for cultivation the subsequent year. With the development and patenting of high-yielding seed varieties and the advent of genetically modified seeds that can withstand the applications of toxic pesticides, many farmers bought into the conventional system of purchasing seeds. There are a number of reasons for this. These seeds were heavily promoted as being scientifically proven to provide higher yields, being resistant to certain pests or diseases, and being hardy enough to help withstand certain environmental pressures (such as drought). This control and patenting of seeds was a key aspect of the transformation of agriculture, removing the control of seeds from the hands of farmers who were involved in complex plant breeding, and relocating them into the hands of corporations who turned them into commodities.[12] Seed saving is also laborious and requires close interactions with plant life in order to rogue and select for the plants with the most sought after qualities. Cleaning and storing seeds over winter is tedious work and requires attention to detail in order to preserve the seeds successfully. However, as the spectre of climate change threatens the productivity and livelihoods of farmers, many of the farmers I encountered have begun advocating for a revival of seed saving practices in order to ensure an increase in genetic diversity that will hopefully confer a measure of resilience. For ecologically-minded farmers, this is seen as a key element in increasing the sustainability of agriculture. Conversely, those

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[12] See the work of Jack Kloppenburg who has researched and written extensively on the commodification of seeds in agriculture and the impacts of making something which should be freely available to all humans (seeds are the building blocks of life), to something that can be owned, patented and sold. Kloppenburg also critically discusses these issues within the context of food sovereignty, biodiversity and biopiracy.

farmers who have bought into the conventional system are looking to technology to increase sustainability. Their narratives reproduce the importance of science and technological enhancement, such as the bioengineering of plant genetics, as the best way to enhance sustainability in the face of an uncertain future. As farmers navigate the complexities of sustainability they rely on diverse sources of information and relationships with others. These relationships contribute to processes of identity formation, learning, and knowledge integration, and trust is an integral aspect of the willingness of farmers to integrate new information.

3. Relationships and Knowledge

Increasing scrutiny of the role of agriculture in climate change and ecological concerns means farmers must find their place within existing narratives surrounding sustainability. For those committed to an agri-business, high-technology model of agriculture, sustainability is often discussed within narratives of sustainable intensification. This entails the pursuit of high yields through monoculture and increasing mechanization in the form of biotechnology, nanotechnology and even robotics, to ensure food productivity in an uncertain future. For others, sustainability requires a commitment to soil health, the maintenance of biodiversity, the revival of rural communities, and increasing resilience so that farmers have the ability to adapt to a rapidly changing climate. Each of these processes is shaped by complex forces including an individual's relationships, values, economic pressures, access to different forms of knowledge and experiences farming. In this chapter, I explore the importance of trust while delving into how farmers learn to become "good farmers" through their diverse experiences and relationships. After a "phenomenological foray" into farming, I explore how farmers' relationships within ecology result in a distinct form of experiential knowledge that has important implications for how they approach their farming systems.

3.1. Learning to be a Farmer

When I began my fieldwork I was particularly interested in the relationships that shape farmer identity and behaviour. I was eager to investigate how these relationships inhibit

or facilitate the access and integration of new forms of knowledge. During my discussions with farmers I would pay particular attention to how they described their relationships and how these connections inevitably helped shape their identity and farming methods. Most spoke about the importance of family as they described how early processes of enculturation shaped their identities as farmers. The majority of the people I spoke with described having grown up on a farm. Their relationships with family members were intertwined with labour and ecological learning, often beginning at a very young age. Helga, for example, who grew up in Germany, did not speak extensively about her experiences growing up on a farm, but described the importance of teaching about farming life to her children and grandchildren. She and her family were so committed to the importance of the specific knowledge and skills necessary for farming, that her daughter-in-law would keep the children home once a week from school so that they could spend the day on their grandparents' farm. This served the dual purpose of reinforcing important and much valued relationships between the children and their grandparents, while also exposing the children to visions and knowledge of ecology and farming life that they wouldn't encounter through a formal education.

During a field day at a farm using biodynamic principles, I was chatting with a couple of farmers about their experiences growing up and how these shaped their decisions regarding production. We were there to learn about cover crops and how planting over winter can help increase soil fertility, while preventing erosion and helping to manage pest and disease pressures (see Image 2). I asked the men if they had learned similar things while growing up. Both admitted that they had not. The first man, who appeared to be in his early forties and was wearing the requisite denim and rubber boots, reflected on my question. He took a minute to tease me about my own rubber boots (which were patterned in black and white polka dots with hot pink trim), before disclosing that he did not remember having specific discussions about the "why's or how's" of farming with his father. He had learned by doing. He recalled following his dad around the farm when he was quite young. He revealed that when he was old enough to take on certain chores on his own, he "just knew what to do". He also admitted to having

questions, specifically recalling that he had questions about the manure pile, but admitted he had never asked them. He expressed his frustration that if "he had only known then what he knows now, that he could have put that manure to good use". Both farmers described themselves as conventional and were quick to assure me that they were attending the field day to expand their knowledge base in order to give themselves more "tools". Neither was interested in transitioning to organic or biodynamic methods, however. They were there to build upon the foundations that they already had and were open to integrating new methods into their production without abandoning their essential commitment to conventional agriculture.

Figure 2: FIELD DAY TO LEARN ABOUT COVER-CROPPING STRATEGIES

When discussing issues of sustainability with farmers, there can be tension between those who prefer conventional methods and those who choose to farm using ecological, biodynamic, or organic methods. The farmers I was speaking with at the field day were quick to assert their identity as conventional farmers, distancing themselves from a commitment to the organic and biodynamic principles they were taking the time to learn about. Despite having very similar feelings about the validity and seriousness of environmental and climate concerns, there is often a divide among farmers based on philosophical differences about what production methods are "best". This can create a certain amount of defensiveness and animosity. Among the conventional farmers with whom I interacted during my fieldwork, many described organic, ecological, or biodynamic farming methods as "risky" and characterized farmers who used these methods as "hippies" or condemned the choice as ill-advised. They strongly believed in the scientific claims-making that tells them that conventional methods are safe, and they insisted that investing in technology was the way of the future and necessary for their future survival.

Conversely, many of the farmers I spoke with who have chosen more ecologically sensitive practices also described their production methods as superior, often relying on narratives of sustainability, biodiversity, the benefits to human health, and a rebellion against "big ag" (symbolized by corporate monoliths like Monsanto and Cargill) to assert their beliefs that their mode of production was preferable. This was even true among farmers who had previously farmed conventionally, but who had transitioned to organic or ecological methods. This hostility has implications for relationships and consequently, the sharing of knowledge. As Robert revealed: "Because I'm organic, I'm really looked down on in the conventional system. *Really* looked down on." Liam, who had grown up farming conventionally, but eventually switched to organic, described his first introduction to biodynamics and organic production methods: "There was a farmer who started this when I was in Switzerland. He came from the university. He started this…and he was a lot smarter than the rest of us…and he started organic farming. And his father

was the biggest opponent of this." Margaret similarly explained that she treads lightly in the farming community when it comes to discussing her commitment to organic farming:

> I have a lot of members of my CSA who I sell vegetables to, who have strong links to conventional farmers, family links to conventional farmers. I mean, their sisters, their brothers, their parents are conventional farmers. I always say I'm organic but I don't make a big deal out of [pause] I don't get very political on it, because I want to maintain [pause] they are supporting me. It's not like nobody knows. They know that I'm an organic farmer and they're supporting me. Why would I want to push something in their face? It's not like people don't know my viewpoints on stuff.

When discussing choices in farming methods farmers can become entrenched in certain modes of thinking that have been reinforced through their experiences and relationships. The integration of new information and experimentation with new farming methods can create tension in familial relationships, as well as among friends and neighbours. This has the potential to create barriers to meaningful change, especially in cases of farm succession where the new generation may want to change a farm system from how it has been managed in the past. One farmer described feeling pressure from family members who appeared to take his plans for changing the way the farm would be managed personally. This divide can also impede knowledge transmission for those unwilling to engage with ideas and methods that they believe are not relevant to them simply because they fall outside of their own schema. Research has shown that there is a tendency for people to disproportionately associate with individuals and groups that are perceived to be similar to themselves (McPherson et al. 2001; Goree et al, 2010), a concept known as homophily (Lazarsfield and Merton 1958 in Shikuku 2019:95). This is not universal, but it *is* unfortunate because as the conversation with the two conventional farmers who attended the field day shows, there is potential for conventional farmers to engage with ecologically-minded strategies such as cover-cropping without completely abandoning their adherence to conventional methods. This would provide the opportunity to enhance sustainability and resiliency without requiring farmers to completely transition their farming systems. This is particularly important as transitioning a farming system from conventional to an organic or ecological approach isn't easy. It requires investment and a great deal of learning, and with this comes risk. For conventional farmers who may

carry staggering amounts of debt and may be fully committed to a conventional approach there is the potential to introduce change in ways that minimize risk for farmers and make it easier for them to consider alternatives.

When farmers discussed how they would access and incorporate information, many also described how their formal education influenced their decision-making. The majority of the farmers I interviewed had completed some form of post-secondary education. Some had studied at an agricultural college, either in Europe or in Canada. Others had pursued university degrees with a diversity of majors—from biology to electrical engineering. Among farmers that had attended agricultural college, including programs at the University of Guelph (focused on horticulture, animal science, or agricultural economics), there was general consensus that the emphasis of their coursework was on conventional agriculture and adherence to high-technology methods of production[13]. For the farmers who eventually went on to incorporate ecological, biodynamic, or organic methods, there was frustration that they could not access the information they needed to be successful through their formal education. This required them to seek out information through other venues.

A number of farmers mentioned having worked as interns on farms other than the ones they had grown up on. This gave them the opportunity to learn distinct skills from other farmers, many of whom were strangers. In a few cases, farmers revealed they had learned by staying with extended family abroad. Taking part in internship programs was common for farmers who had chosen to pursue organic despite having grown up on a conventional farm. In order to gain the skills and knowledge they needed to be successful, they sought out other farmers and offered their labour in exchange for the opportunity to learn. This process of farm internship is not new, but it has gained in popularity. It attracts farmers from diverse locales (one farmer I spoke with had welcomed interns from Australia, Germany, and the Netherlands). It also provides the opportunity to learn about farming for people who may have no experience, but who may

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[13] The University of Guelph began offering a Certificate in Organic Agriculture in the Fall of 2018 which requires the completion of 2.5 credits.

be interested in pursuing agriculture. There were a few farmers that I interviewed or encountered during field days who were new to agriculture. They described internships and taking part in field days as integral to their education.

There are a number of different programs that can connect interns with opportunities, both at the local and global levels. In south-western Ontario there is CRAFT (Collaborative Regional Alliance for Farmer Training) which is a regional chapter of a much larger organization that brings together interns with opportunities on ecological farms. At a global level, WWOOF (World Wide Opportunities on Organic Farms) connects farms with potential interns from around the globe. These are just two programs, but there are many others. It is notable that these programs are based on an exchange of labour for food, housing, and the opportunity to learn. Money seldom changes hands, although host farmers said they sometimes provided small stipends to interns. During my fieldwork I did not hear about any programs or internship opportunities specifically targeting conventional production methods. A brief internet search did not readily provide examples of such opportunities, although my search was not exhaustive and there may be many such internships available. As conventional is the most common form of farming in Ontario, knowledge can be shared more readily among family members, neighbours, and friends. In speaking with conventional farmers, many admitted hiring outside labour, especially during times of increased labour intensity. These hired labourers would learn during their tenure and would also have the opportunity to share the wealth of knowledge they had accumulated in previous years as hired labourers, or on their own farms.

During my research I had the opportunity to speak with two interns, as well as farmers who had welcomed them. Overall, both groups spoke positively about the experience, although one intern described an unsettling encounter on another farm the previous summer. She described sneaking away during the night because one of the family members made her extremely uncomfortable and fearful for her safety. A farmer who had welcomed many interns over the past 10 years had mixed feelings about internship programs. She spoke very positively about the impetus behind the programs

and revealed that she had connected with some great people. However, she also described instances where she had welcomed in interns who were happy to have a place to stay and food on the table, but who seemed unwilling to put it the amount of labour that was expected in return.

In the context of ecological and organic farms, internships and farm organizations are increasingly relied upon to enhance farmer networking and knowledge sharing. Decreases in rural populations as well as subtle tensions between family members and neighbours because of adherence to different production principles, means that farmers often connect through organizations that bring together like-minded farmers. Apart from agricultural unions, there are also associations based on commodity production (such as the Grain Farmers of Ontario, Dairy Farmers of Ontario, etc.), as well as organizations focused on environmentally sustainable agriculture (such as the Ecological Farmers of Ontario and Everdale Farm). Lukas described his experiences with some of these organizations:

> I really like them (the networking groups). I really wish there was more time to interact. Like last year the conference was in London which was awesome. I attended everything, I talked to people a lot. Went to the Guelph Organic Conference and I'm part of the CRAFT Network-have you heard of that? CRAFT is Collaborative Regional Alliance of Farmer Training. There's about 20 [pause] 17–20 farms in south-western Ontario this year and we get together twice a year and we all have interns on our farm and so it's a support network for helping each other make sure our interns' experience is good and so the biggest part of that is that 6 times during the summer we have a CRAFT day. Every month basically we have a CRAFT day, and each farm will take turns hosting them and the other farms will send all their interns, have a session, so [pause]. We meet in November and February and plan that out. You get to know the network of farms and they're all similar types of farms. Small-scale, direct market is typical, right? Mostly vegetables, some animals. So that's been really good. EFAO is great, but again I find there's so many events going on that I just don't have time for. And partly it's because I do work another job still. So when I'm not busy farming, like now I'm transitioning into my winter job, uh that's why I'm here [pause] so I find I don't have a lot of extra time. Otherwise I would love to. Not having an off-farm job I'd have more time for that.

Leore, a diminutive woman with long brown hair and a commanding voice, described the importance of these groups to her own agricultural education. She and her husband had purchased their farm because they wanted to get out of the city. Neither had farmed previously. She said the land had never been farmed conventionally, so they did not have to transition. This made it an easy decision for them to choose organic certification as a means of increasing the profitability of their farm business. When I asked how she learned about farming methods she said:

> Listened to old people, went to the Ecological Farmers, which was the best actually—to go on all their tours. That way we met people and it was a lot of [pause] a lot like Trent University in brainstorming and an open forum for everyone to discuss their ideas. So I really liked the Ecological Farmers at first. So much is just obvious if you understand how the environment works and basic science, biology, you know? I think most organic farmers are university educated, so that's more of a given. I was really disappointed when I became a farmer and then I asked neighbours who became conventional farmers and people I met around [pause] how little they knew. You know?

These types of organizations and the events they sponsor provide important opportunities for farmers to connect and share information, network, devise marketing strategies, and create strategic alliances. In a time of increasing pressure on farmers to enhance the sustainability of their farming systems, these organizations are providing unique opportunities for all farmers to share information and learn from the experiences of others who are experimenting with a variety of crops and methods, many based on ecological and biodynamic principles.

Lukas, the organic pig farmer, described how he had learned about organic methods from a neighbour approximately a decade ago: "Just a farmer to farmer type of thing. [My neighbour] had a field day to encourage more people to grow organic because he was also a marketer. Both my neighbour and I decided to go organic because of people like him, back then." He described the changes he had seen in how farmers access knowledge over the course of his lifetime:

> The organic system is still evolving, we're still learning. My neighbour and I, we're kind of on our own here. Like, we don't really have any experts or extension

> representatives anymore. So if we have a question, we don't really have anyone to ask, except Google maybe (chuckles). Organically, you mostly have to rely on salespeople unfortunately, and they don't always tell you what you need to hear. They just want to sell you their stuff. So [pause] yep. You have to be wary and you are very much on your own when you are organic farming. So the more you research on your own, the better farmer you become. You can't rely on other people. And that's the problem with agriculture too. Most farmers just rely on their input suppliers for all their information, conventionally speaking. Organic-we don't really have that, so [pause] you know?

As Lukas disclosed, it is not uncommon for farmers to rely on information received by seed companies, equipment salespeople, and the fertilizer industry who often have sophisticated sales pitches. My research revealed that this was also true of farmers who were certified organic, or who adhered to biodynamic or ecological methods—although to a lesser extent. Farmers are just as susceptible to advertising and salesmanship as anyone else and as narratives of sustainability gain traction in the food system there are an increasing number of "natural" or "organic" products marketed to farmers who are outside of the conventional system. A common misconception among the public is the idea that organic farmers don't use pesticides. They absolutely do. They just use products that are derived from natural sources. As farmers seek new ways of enhancing their resilience, there are many companies just waiting to capitalize on new market opportunities.

Many of the farmers I spoke with communicated with other farmers online as a means of accessing information. There are a number of discussion boards that are focused on certain methods of production or are targeted to specific commodity markets. For example, there are forums that connect poultry or dairy farmers. I spent some time observing interactions on a number of such sites during the course of my fieldwork. Typically, someone would post a question, perhaps regarding a certain type of feed, or the emergence of a particular disease, or about experimentation with a new plant varietal. Other farmers would then respond based on their own experiences and challenges. This method of connectivity has created new opportunities for farmers to access and share information. I was chatting with Adam, a relatively new farmer who primarily sells at a

farmers' market, about how he accessed information. He mentioned that he read a lot of books and I asked him if he accessed information online:

> For sure. For sure. That's probably what's changed things. You have to *do* things to learn how to do things, of course, but a little bit of book farming helps and the internet revolutionized that. I think ideas are shared more quickly and you don't have to make as many mistakes if you listen to what other people have done with crops. So I'm sure that helped, but I didn't try it enough. So I guess the other thing too is your willingness to go and try something. You really need an example to go from. Even if you're sticking your neck out and trying something brand new, well you need some basis to say "well this is going to succeed". You know, even reading what someone else has done or reading some examples or getting some inkling that you're not crazy to do this. Right? So our grandfathers, they would have based it on what hey saw around them, or their own ancestors, right? So I think in that respect, the internet and books of course, have helped a lot, because it's easy to find examples of people who are doing what you might want to try.

As Adam discussed, connectivity through the internet provides farmers with the opportunity to engage with a diversity of knowledge and experience. Farmers are able to interact with a multitude of information sources with relatively little effort in comparison to taking part in field-days or farmer-to-farmer extension. As I spoke with farmers about the potential of the internet to enhance knowledge sharing, many acknowledged that online engagement offered new possibilities. My expectations were that older farmers would be less engaged online, but this was a misconception. Some older farmers admitted to being very active online, especially when experimenting within their farming systems. A few farmers expressed frustration at poor download speeds offered by their internet providers as a reason for limited interaction in online forums.

What emerged during these discussions was that trust is a key component when farmers are seeking out and integrating new information. From the farmers I interacted with during my fieldwork, it appeared that farmers will much more readily accept and incorporate new information if they trust the source and if they believe the information has potential value to them. As Buck and Alwang note in an article about agricultural extension among farmers in Ecuador: "An important, yet understudied, determinant of uptake of new knowledge may be the recipient's trust in the motives of the information

source. Farmers do not value all sources of agricultural information equally. Some farmers may trust neighbouring farmers while others, if given the opportunity, may be more inclined to trust agricultural technicians" (2011:685). In southern Ontario, some farmers are swayed by the scientific claims-making made by "big ag" and invest heavily in new chemicals and technologies under the promise of significant increases in yield and therefore income. Others are deliberately mistrustful of corporate motivations and eschew information that reinforces the paradigm of industrial agriculture.

Buck and Alawang (2011) differentiate between two types of trust—trust in the motivations of the person disseminating the information, and trust in the competence of that individual. They argue that trust in the motives of information sources is more of a determining factor when it comes to knowledge integration (Buck and Alwang 2011:687). Different farmers prioritize different types of information. My experience with farmers in southern Ontario is that they tend to seek sources of information that align with their production philosophies and politics. They more readily engage with sources of information that reinforce what they already want to do, or seek answers to problems they already have.

As farmers seek to access and integrate new information, the reliability of that information is often judged based on complex factors including critical engagement with the motives of the source of the information (farmers are more likely to be skeptical of knowledge disseminated by a seed distributor than information received from a neighbour), as well as how easily the information can be integrated into an individual farmer's personal politics and production philosophies. Relationships matter when it comes to trusting the source of information, but the greatest barrier to accessing and integrating new knowledge isn't relationships (or lack thereof). Nor is it trust in the competence of an individual, when you consider that both conventional and organic farmers often have successful farm businesses and so both could be judged as highly competent (although high yields are certainly not the only indications of competence, especially among ecological farmers). The greatest barrier to the exchange of knowledge

is how certain forms of knowledge are integrated into identity and how these associations have been politicized in ways that create divisions among farmers.

When discussing the sources of knowledge which were *most* valued by farmers, there was again considerable convergence. Many farmers I encountered during my research reported that they liked hearing from others what has worked in the past, as well as what is working now, and sometimes, even more importantly, what *didn't* work and why. However, most described their own experimentation, successes, and failures as the most integral aspect of their learning. Experiential learning was highly valued and trusted. As Adam stated, "you have to *do* things to learn how to do things." As I listened to farmers talk about their learning, they would discuss the ecology of their farms and how they would take all of the knowledge they had acquired from disparate sources and apply it in the unique context of their farming systems. They described learning that was intimately tied up with ecology as they adapted, experimented, and evolved along with the changing social, political, ecological, and economic pressures that are a constant in farming life. Their lived experiences shaped their identities and realities in complex ways.

Phenomenology, broadly speaking, is the philosophy of human experience. Critical and "sophisticated phenomenological approaches in anthropology, can be realized through ethnographic field research methods that attend at once to the tangible realities of people's lives and to the often interrelated social, biological, corporeal, sensorial, discursive, cultural, political, economic, psychological, and environmental dimensions of those realities" (Desjarlais and Throop 2011:97). Thinking critically about how farmers interact with and experience ecology has important implications for their production and how they approach issues of environmental sustainability. In order to consider how farmers experiences of ecology are inevitably intertwined with labour, productivity, economics, and identity, we must take a journey into the field.

3.2. A Phenomenological Foray

It was a morning in mid-July. It was still early, only about 8:00 a.m., but the sun was shining brightly and the air was already unbearably thick with humidity. If you live in southern Ontario, you know the type of day I mean. The type of day where you sweat even when immobile. A day which will inevitably spawn vicious thunderstorms come early evening. It was my second day volunteering on an organic farm and I had been sent out to the potato fields with a rusty hoe to do some weeding. I made my trek through the pasture and down the path that leads to the potato fields. There were several acres of peas growing on my right, but it was difficult to see the plants as the field was overgrown with weeds carrying bright yellow flowers. I started on the left side of the potato field, the side that borders the peas, and began moving methodically down the row, bending, grasping the weeds as close to the soil as possible and yanking them out, throwing them to the side where they were left to decay in between the rows. If I came across a particularly stubborn root, I would use the hoe to loosen the soil around it so that I could pull it free. Weeding on an organic farm is not as simple as sounds. It is back-breaking work and tedious, but certainly not mindless. You must be careful not to accidentally pull up any potato plants and to leave some weeds strategically placed. Allowing some weeds to flourish helps to prevent soil erosion and provides a modicum of protection against insects and hungry wildlife who may choose to feed on the weeds instead of the crops.

As I was weeding, the mosquitos buzzed incessantly and although I was wearing insect repellant I found myself stopping frequently to flap my hands around my head in order to dispel that annoying zzzzzzeeeet. After several hours of moving up and down the rows, I needed a break. My lower back was throbbing, my knees were aching from the squatting, and the soil had invaded my work gloves and was so deep under my fingernails I feared I would never get it out. I straightened up and looked around—and saw nothing but potatoes. Row, upon row, acre upon acre. I was at the bottom of a small valley and there was nothing else around me for as far as the eye could see. Although I understood that it was just a trick of the landscape and that the house and barns were just a short ten minute walk from where I stood, I felt truly isolated and alone, a feeling I cannot

remember having experienced before. As I stood there I really began to appreciate the smell and the feel of the soil. I noticed the birds that kept flying overhead and I started to think very critically about how very social our lives are. For this feeling to be so powerful it had to contrast significantly with my lived experience and this forced me to think critically about the social lives of the people who choose agriculture as a way of life. Although I had witnessed the closeness of family and the importance placed on doing things with and for your neighbours in the farming community, for the first time I was struck by how very solitary a lot of the work done on farms must be. At the organic farm at which I was volunteering, after breakfast each family member leaves the house with a certain responsibility in mind. Barn chores, ploughing, weeding, fixing a fence, making flour. Each of these activities is a contribution to the overall workings of the farm and so ultimately a communal activity. However, each activity on its own is a solitary endeavour. Much of the day is spent alone, with only the landscape, animals, insects and plants for company. I began to see how farming involved ecological complexity of a sort that I had not before anticipated and one that offered new areas for me to consider in my research.

As farmers spend much of their day doing solitary forms of labour (in terms of their interactions with other humans), considering their relationships within ecology is integral to understanding how they experience landscape and the processes that shape what it means to be both farmers and what it means to be human. Working alone removes the distraction of human forms of sociality and reinforces the importance of other forms of relating. These entanglements shape farmers' lived experience. Laura Ogden (2011) discusses similar processes of interaction in her ethnography *Swamplife* which explores the lives of white hunters in the Florida Everglades, whose identities and labour are entangled with alligators, mangroves, and environmental politics.

Donna Haraway describes human relationships with other species as a "becoming with". She challenges us to recognize our connectivity and interdependence and tells us that "If we appreciate the foolishness of human exceptionalism then we know that becoming is always 'becoming with', in a contact zone where the outcome, where who is in the world, is at stake" (2003:244). This idea is at the heart of my ethical obligations

and my political project, which is to acknowledge the fact that humans do not live separate or apart from an ontologically distinctive nature, but that we live in interdependent relationships with other species without which we cannot survive. This idea of "becoming with" is integral to what I wish to explore. Through a phenomenological foray, I will take you into the farm to carefully consider which relationships shape what it means to be a farmer and which interactions shape farmer knowledge as it pertains to ecology. This research does not explicitly contribute to multi-species scholarship, but for me to ignore the complexity of lives that make up what it means to be a farmer would result in a very anemic ethnographic representation of the complexity of farmers' lives.

In agricultural systems there are many opportunities to consider the relationships between humans and others. The soil is the heart of an agricultural system. It is a mess of liveliness, its own community, with millions of life forms, all living in complex and transient assemblages. We can consider how the farmer's relationship with the soil is practiced. How do they decide when the soil is ready to be planted? What sorts of communications take place, and how are communicated messages perceived (touch, smell)? How are the fields prepared for planting? Is the soil nurtured with compost and other detritus? Are chemical fertilizers introduced into the system? What are the implications of these actions? For the soil and the millions of life forms there? For the farmer and his future productivity? For future generations of all interdependent life forms? How do relationships with the soil change based on the introduction of other actors, such as farm implements and tractors?

Animals have an essential place in the ecologies of agricultural production. Domesticated animals such as cows, pigs and chickens may be considered companions, workers, commodities, objects, or more likely, complex entanglements of each of these (Haraway 2008; Weis 2013). We might then consider not just how humans and other animals relate in the systems they share, but what other species (e.g. soil bacteria, insects, plants, etc.) contribute to ecology. The soil conditions help determine the nutrient value of the haylage, which is fed to the animals, who in turn process their food and return it to

the system in the form of manure, which often ends up feeding the soil as compost (considered a "closed" loop or system). The animals themselves are then sent to slaughter, entangled in complex processes of becoming food to feed both humans and other animals. Other domesticated animals also have important roles in agricultural systems. I have yet to visit a farm where I was not greeted with at least several animals (most often dogs and barn cats). Dogs play an important role as what Haraway (2008) describes as "companion species," providing security against outsiders (both human and non-human), giving love and affection, demanding attention and food. Cats are similarly involved in complex webs: hunting barn mice who eat the grain and chew through wires in the barn; demanding fresh cream from a newly milked cow; as fodder for fleas, other insects, and coyotes that skulk around the farm at night.

Non-domesticated animals also reveal themselves as part of the complex webs of relating that make up farming systems. Each of these animals is involved in complex processes of becoming. Becoming a nuisance, a wonder, a welcome visitor, or a threat—something that may either be nurtured, ignored, or destroyed. The groundhog, digging holes in the pasture that may cause a horse, cow, or unsuspecting human to break an ankle. The deer, who slip into the fields at dusk and dawn to partake in the rich bounty of the fields. The skunk, shambling around the berry patch. The wild turkeys, pecking through the potato fields looking for Colorado potato beetles. The hawk, soaring above, looking for voles in the pasture. The rabbits who merrily munch on the fruits of agricultural labour. How is the farmer's experience of moving through the landscape changed by these interactions? What behaviours result? We can see the importance of these non-human animals and how they shape farmer behaviour by witnessing the farmer building fences, spraying bloodmeal to discourage deer, putting poison down a gopher hole, or stopping his labour to marvel at the beauty of an uncommon bird in flight.

Insects also play an integral role in farming systems, both as facilitators and as pests. Their intractability makes their role in ecology very compelling. Farmers experience their relationships with insects acutely, both as pests and as mutualists. Certain insects, such as bees, butterflies and certain types of beetles, are essential to many

farming systems and are therefore encouraged. This encouragement occurs in many forms including choosing not to use certain insecticides, to the creation of "bee friendly" habitat or "beetle banks," to social and political activism to prevent loss of habitat or the use of dangerous chemicals. These complex webs of relating extend to the aural and the tactile, as bees drone nearby, or a beetle scuttles across a weeding hand. Other insects are unwelcome, such as those that may damage crops (certain aphids, borers, beetles, caterpillars), and the processes of becoming a farmer are shaped by these insects. The conventional farmer may apply the latest chemical pesticide, while the organic or ecological farmer may use "natural" pesticides (pesticides that are derived from a natural source such as a mineral or plant), or take steps to encourage other species that will feed on the pests (e.g., the introduction of more ladybugs to control aphids).

Plants and trees are also hopelessly caught up in these webs of relating. Some are nurtured, planted as seeds or tubers, encouraged, fed, watered if necessary, protected, in the hopes that they will become food for either animals or people. Some will grow where they are not wanted and will either be left alone as a distraction for pests and to help prevent erosion, or will be plucked from the earth unceremoniously and left to decompose and become nutrient rich fodder for the myriad of lifeforms in the soil. Trees may be either cleared to make room for more agricultural production, left alone, or planted to help protect fields from the wind and to encourage the addition of other forms of life that take part in the system. They may be enjoyed as a shady respite from the heat of the day, or they may be cultivated as commodities themselves.

While I have outlined some of the other "living" beings that make up the complex assemblages of an agricultural system, many non-living elements of ecology are also entangled in these webs of relating. There are rocks that sometimes must be moved for ease of ploughing, or that seem to appear as if by magic and must be tossed aside while weeding. There is the water: the rain that falls, sometimes when needed, sometimes at inopportune times; the creek that runs through the pasture, where both cows and other animals stop to drink and where frogs, snakes and insects attend to their own processes of becoming. There is also the weather: the winds that provide a brief respite from the heat,

cooling the skin and relieving you from the blackflies, or blowing away precious soil as dust across the fields. There is rain, snow, sleet and hail—some may provide much needed moisture, while others may destroy months of labour. There is the technology—farm tractors, balers, and other farm implements, which may disrupt the intimacy between the farmer and the rest of the farm ecosystem, but without which the toils of labour would be too much to bear.

It is also important to consider how moving through space affects the processes of "becoming" for farmers. How are the senses engaged and how does this affect agricultural practice and webs of relating? What does the farmer see as they move through the landscape? How does this change as their method of transportation changes? What do they feel when they walk across the land, ride a horse, drive a truck, a tractor, or a combine? What do they smell? What sounds do they hear? Can you really hear corn growing? What about the touch of an animal's nose to your palm, or the feel of the dirt under your fingernails? Most importantly, how do these complex relationships shape what it means to "become with" (Haraway 2008)?

Taking a phenomenological approach to understanding the lived experience of farmers can illuminate how very entangled their lives are with the rest of ecology. The description I have provided above was based on my own experiences farming as well as snippets I gleaned from conversations and interviews with multiple farmers. My experience speaking with a small group of farmers is that they experience these phenomena in a variety of ways and differ greatly in how they describe these experiences. Jack, (the conventional vegetable farmer), for example, spoke with affection for his interactions with the wildlife he encountered, while Lisa, an organic garlic farmer, spent a great deal of time speaking about her experiences with plant-life on her farm. What became apparent through multiple conversations was that the lived experience of these farmers shapes their knowledge of ecology in very specific ways and reinforces the reality that our lives are interdependent on the others with whom we share ecology. These multi-species entanglements both shape and inform the survivability of all species,

including humans, and shape farmers' understandings of ecology as well as their livelihoods.

Sites of agricultural production are what Ogden refers to as "assemblages of collective species, the products of collective desires and the *asymmetrical* relations among humans and non-humans" (2011:28, my emphasis). Donna Haraway stresses that these complex ways of relating to one another are "almost never symmetrical" ("equal" or calculable), but that: "relations of use are exactly what companion species are all about" (2008:74). So the political impetus behind multi-species ethnography is not about trying to create the illusion that all species are equal (and by "species" I am borrowing from Haraway—a definition that is inclusive of all sorts of human and non-human beings, and "others besides" (2008:164). It is about acknowledging the asymmetry, respecting our relationships with other species and about bridging the divide between different ways of knowing and experiencing the world (Haraway 2008). It is about dismantling Marxist notions of use value and exchange value and considering how our relationships with others shape who we are. Latour argues for a symmetrical anthropology. He suggests that the principle of symmetry does not suggest the establishment of equality, but that "when balance of symmetry is reestablished with precision, the discrepancy that allows us to understand why some win and others lose stands out all the more sharply" (1993:94). What Ogden calls "landscape ethnography", a variation of multi-species ethnography, provides the opportunity to "be attentive to the ways in which our relations with non-humans produce what it means to be human" (2011:28). To consider these encounters is not only political, but provides the opportunity for a richer ethnography. I am acutely aware of the fact that these assemblages are always only temporary, always becoming, always in process. Therefore what I hope to document through my ethnography is not a picture of what is, but what "becoming" looks like.

I felt compelled to include this phenomenological foray into farming to highlight the complexities of multi-species entanglements that occur as a result of agricultural labour and to emphasize the importance of these relationships in farmer decision-making.

Many of the farmers I spoke with recognized their place *within* ecology as opposed to seeing themselves as set apart, or taking actions either for or against the rest of ecology. My experiences with farmers suggests that they are very aware of the complex entanglements of labour, economy, politics, and ecology that shape their livelihoods. As I emphasized in Chapter 1 when speaking with Klaus about political ecology, what, for many farmers, is just "common sense" was not immediately apparent to me as a researcher with very different lived experience. I had to engage with theorists such as Bruno Latour and Isabelle Stengers, and then take part in agricultural labour myself before the connections became clear. Farmers' unique experiences within their ecosystems also have important implications for knowledge acquisition and underscore the potential contributions of agrarian science to understandings of ecology.

3.3. The Rules of Engagement

The farmers I engaged with throughout my fieldwork widely recognize that agricultural systems are reliant on multiple actors within the environment for successful production (pollinators, microbes in the soil, etc.). Farmers engage, not just with the landscape, but with the myriad lifeforms that make up the farming system. Sociality extends to include the rest of ecology, as inter-species relationships are integral to how farming systems work. These relationships shape knowledge and decision-making in ways that often escape the notice of researchers and that may prove valuable as we seek more nuanced understandings about how farmers make decisions that ultimately affect the sustainability of their farming systems.

Of the farmers I spoke with, the majority (approximately 75%) expressed humility and were acutely aware of their relationships with other species and of the complex processes and interactions that are critical in the food web. However, the relationships that farmers have with other species are unique. They are intricately tied up with identity, economy, and labour. Farmers make decisions that result in the life or death of other species through the processes of their livelihood. Many who took part in my research appeared conscious of what that responsibility means. Despite behaviour that sometimes pointed to the contrary, every farmer I spoke with was aware of the fact we rely on our

relationships with other species for our own survival. As noted in the previous chapter, discussions of the "bee issue" were abundant, with farmers emphasizing the fact that without bees and other pollinators, many of the crops we rely on would be impossible to grow. Many farmers were also quick to point out that increased emphasis on mono-cropping practices has reduced adaptive capacity, not just of farmers themselves to weather the potential fallout of crop failure, but to humanity as a whole. Three farmers I spoke with suggested that "putting all of our eggs in one basket" in the form of reliance on a few key crops (corn, soy, wheat), has reduced humanity's ability to withstand future climate challenges.

However, the realities of death and the necessity of killing are also an inevitable part of agriculture and of ecology. Many of us are shielded from having to grow and kill our own food. "When we think of multi species connectivities, eating is central. One's eating and living also means killing other species, directly or indirectly" (Satsuka 2011:137). The farmers with whom I work often discussed how removed many consumers are from the realities of food production. Farmers do not enjoy the luxury of being removed from the realities of killing. They understand what it means to grow food and the labour involved in tending to the livelihoods of plants and animals in the hopes that they will feed us. They understand that we rely on other species for survival and that in order to eat, we must kill. Their labour requires them to make decisions about which plant and animal lives will be nurtured, and which lives become expendable as a result. Giorgio Agamben (1998) argues that in contemporary western understandings, the word "life" refers exclusively to the biological without adequate consideration of the experience of "living," or quality of life. He refers to the Ancient Greeks who had two different words to refer to life—*bios* (the ways in which a life is lived) and *zoē* (the biological fact of life). His concept of "bare life" refers specifically to the privileging of the biological over the way a life is lived. Agamben's concept of political lives/bare lives is useful for understanding farmers' interactions within ecology. Farmers often reduce plant and animal life to *zoē*, recognized as only biological beings and outside the domain of the political, and therefore killable (Agamben 1998:183). Although Agamben's

concept of "bare life" does not explicitly attempt to disrupt the human-animal divide (as he is most forcefully engaged with biopolitics among human populations) his concepts critically engage with the concept of human life to the point where it eradicates the distinction between human and non-human animals—a distinction most farmers are not willing to let go of.

Killing and eating is a multi-species connection that sustains us and allows us to survive, always at the expense of others. We imbue the others with whom we share Earth's ecology with different values, histories, and identities based on the category of "species" despite the reality that "species" as a biological concept is more flexible than one would suppose (Hey 2006). These attributions are always political and shape the rules of engagement. The concept of "species" fixes measurable ideas of relatedness causing humans to align with some species more than others (Ingold 2006 cited in Yates-Doerr 2015:39). Species hierarchies exist often privileging what we find recognizable, valuable, or pleasing in its countenance. From Christian stories of the Ark to Aristotle's Scale of Nature, it is common among some cultures and religious traditions to value mammals much more so than plants, insects, or bacteria. Most of us would recoil if asked to kill our own cow for dinner, but we pluck plants out of gardens and thrust them unceremoniously away, paying no attention to their death throes. We minimize killing plants, even as their leaves shrivel, or while their roots gasp for water and get only air. This is not because any one species has any more intrinsic value to our survival or to ecology than any other, but precisely because we imagine that some species are *like* us in some way. We lobby to protect polar bears, elephants and whales, while mosses, lichens, trees, and arachnids are just as seriously endangered (Blok 2013).

There are a number of multi-species discussions that reinforce species hierarchies, using posthumanist rhetoric to elevate the status of other animals, often mammals, in order to spare them from the horror of being killed and eaten. The problem with these arguments is that they ignore the complexities of multi-species entanglements. These politics shape our food system in complex ways. In Canada, there are increasing pressures from the vegan and vegetarian movements to change livestock management

practices and reduce meat consumption. The arguments surrounding animal agriculture often centre on animal welfare and the environment. These are important issues. Factory farming is implicated in horrific animal abuses and increased meat consumption has resulted in rising greenhouse gas emissions (Weis 2013). The horrors of factory farming are often attributed to small and medium scale farmers despite the fact that many of these farmers have complex and sometimes loving relationships with the animals in their care. The daughter of one of the farmers I spent time with posted pictures of herself in her prom dress on Facebook—not posed with her date or her best friend, but with her prize-winning cow. Affection and caring of animals is even the case with some industrial farmers who have been forced by the market into a certain mode of production (Hansen 2018). Adam discussed with me the important role that animals have to play in agriculture:

> Environmentally, we should eat less meat, but animals aren't the same as humans. If you see the ecological relationship between soil and farming and how animals fit in [pause]. I mean, if we want to farm organically I think it would be very misguided to say we can do it without animals. I don't use animals for work, some people do, but I need animal farms if I don't have the animals myself [pause] I need animal manures.

Animals have an important role to play in agriculture. All of farmers I engaged with throughout this research understand that healthy farm ecologies rely on a multiplicity of lives, including plants and animals. From an ecological perspective, farming works best when plant cultivation is combined with animal husbandry. Animals provide much needed fertilizer to help aid in plant growth, reducing the need for chemical fertilizers, while at the same time providing nutritional and economic diversification (Reynolds et al. 2015). As Adam further described:

> Recognizing the important connections between species, right? So should we be teaching people that don't know? Is that our place? I don't know. Encouraging people to have a closer connection to farming is probably the answer, right? If we can encourage people to focus on the environmental side rather than the animal rights side that would be worthwhile. Animals play an important role in our ecosystems. It's probably because [pause] it's a city thing really. Not to be pretentious because of living on the farm, but I've lived in the city. If you're really

> separated from a farm and you don't understand any of it, then that's when you can come up with these ideas.

Margaret similarly spoke about the importance of integrating animals with plants as ecological systems must work in concert in order to be healthy:

> Actually I think the thing that concerns me most is the loss of hay and pasture from the landscape because I have seen over my lifetime, it just disappeared and I didn't realize. I just saw not very long ago, so [pause] we've been losing land in southern Ontario to development, all kinds of things, but the area of farmland has not decreased, so all of that loss, is a loss of hay and pasture and that has huge implications for the environment. Hay and pasture is good to have as far as protection of the soil, as far as protection of some sort of habitat for other animals, insects, birds, whatever. So in some ways [pause] and of course the loss of hay and pasture is also about the total separation of livestock and crops and that's not the way nature works. Nature doesn't work by putting animals over here and crops over there. It works by them being integrated.

While farmers speak very frankly about the necessity of killing and the practicalities of farming (which requires ensuring the survival of some at the expense of others), their relationships within ecology are complex, encompassing empathy and sometimes a show of reverence that borders on cosmological. Ed Burt, a retired farmer from Manitoulin Island with whom I had a phone interview, spent a great deal of time explaining the importance of his relationships within ecology. He described his joy at seeing deer in his pasture and noted that when he decided to retire he missed the lowing of his cows so much that he had a small barn built on his property so that he could still have a few animals. Ed published his own book on his experiences farming, which he sent to me after our conversation. In the preface he states: "With the fungi, microbes, bacteria, sun, rain, light and darkness, the planets and all the life forces and the nature spirit, I sometimes feel like I'm just going for a ride. What a ride"(2016:ix). Multi-species intimacies move beyond materiality to encompass imaginings—the ephemera of relationships. There does not have to be physicality for there to be connection and farmer identity and engagement with ecology can be shaped by affection, imagination, nostalgia, and morality.

In attempting to gain an understanding of how farmers make decisions regarding their production, it is important to acknowledge that relationships within ecology are shaped by more than just economics and practical considerations. Gordon, an organic dairy farmer that used to farm conventionally, leveraged narratives of morality and ideas of a natural order as he described his frustration with manicured lawns and ditches and how this sensibility has been incorporated into farm ecology to the detriment of "wild species:"

> This ditch out here, now there's lots of weeds and shrubs and garbage growing in it, and stuff growing on the fence. There are a lot of wild animals. There's snakes and frogs and turtles, rabbits and all the rest growing in there. Okay? And there's a lot of weeds, you know? There's this *terrible* (sarcastic emphasis) weed that the monarch butterfly potentially grows on. There's this other terrible weed that these other bugs and birds grow on and eat. You know, these things are terrible [pause] they're going to kill you and me totally (sarcastic huff). **Or,** would you rather have the manicured lawn that's this tall, sprayed four hundred times and beautifully green and flat? Even my wife [pause] "why do you want weeds in the ditch"? My argument is, if we can't look, maybe natural selection will get rid of those of us who are bad drivers (laughs). There's too many people now. Do we have to kill everything else so that we can live? It's sad when it's us, or our children or our grandchildren, but it is natural selection and unfortunately we are using natural selection to wipe out every other species of life that ever existed on this planet. **Is this fair**? [Strong emphasis and enunciation]. That's one thing that I am looking at. And the farmers are doing the same thing. "I need that one row of corn, so I'm going to bulldoze out this four foot row of fence line". That fence line has got weeds and plants and [pause] they (neighbours) just took out a row of fence line right there, I think it was ten feet wide and it's been there a hundred years. There's weeds and plants on there that probably don't exist anywhere else, and they've wiped it out. And that was habitat for all these wild birds and species.

How, as anthropologists, do we scrutinize and remain objective about farmers' representations of the other species they speak for (Kirksey et al.2014:3)? Affinity with research participants can cause us to overlook contradictions between what people say and what they do, or to over-generalize and make assumptions that reduce the complexity of how farmers experience ecology. Reflexivity requires us to examine our own politics to try and discern whether or not we are projecting our own perspectives and moralities onto others. The limitations of fieldwork required me to rely on what farmers said about

their experiences and integrate that into what I observed in practice. When it came to ecological relationships, some farmers had integrated philosophy and practice much more than others. Farmers are required to make complex decisions regarding their farming systems that must take into account the political climate (including current legislation), economic factors to ensure their livelihoods, as well as their relationships (with all beings in ecology, including humans). These sometimes-competing interests require farmers to make decisions that may not always make sense to others, or that may seem to contradict the values they espouse. Integrity, morality, and conscientiousness exist on a continuum and as economic precarity threatens survival, an individual's position on that continuum can shift. The diversity of factors that influence how closely behaviour conforms to a set of stated beliefs can be highly personal and are often not easily discernible in a research encounter.

Farmers' complex relationships within ecology result in a distinct form of knowledge—what I refer to as "agrarian science". Farmers must analyze and integrate the diverse information that emerges as a result of their relationships with humans and with the rest of ecology, and apply it within the context of their farming system. Soil fertility, moisture content, the emergence of a particular disease or pest, complex weather patterns, and the interactions between multiple actors within ecology, are all processed and integrated within their existing knowledge base. This form of ecological knowledge is viewed as essential to the success of the farm. Farmers also engage in experimentation as they attempt to modify the knowledge they have gained from disparate sources so that it can be useful within the ecology of their particular farm. Agrarian scientists are innovators and generators of knowledge who take part in practical experimentation, just like all scientists. In taking these processes seriously there is the potential to broaden our understanding of ecological relationships in ways that may enhance sustainability in agriculture.

4. Cultivating Knowledge

When considering how adaptation and innovation are happening in response to climate change, it is important to note that adaptation and innovation are, and have always been, an integral part of farming. In agriculture, adaptation is a way of life. Adaptation is necessary to be able to cope with changing soil conditions, weather, threats to crops (diseases, pests, non-human animals), the need for crop rotation, planting preferences, and the vagaries of economic markets (see Reid et al. 2007). Elizabeth Fitting describes this as a necessity and that each season agricultural producers require an "adaptive performance" depending on factors such as weather and household resources (2011:206).

Farmers are innovators and generators of a unique form of knowledge as a result of their interactions within ecological systems. In this chapter I will explore the diverse ways farmers experiment with different crops and farming methods and how they gather and interpret details about this experimentation so that it can be shared with others. It is important to recognize that farmers are not just passive or reactive in the processes of adaptation but are *active* in attempting to enhance their capacity and resiliency to climate change by taking part in practical experimentation and knowledge sharing. As was shown in the previous chapter, with more diversified farming methods and access to new technologies and social media, there are farmers in southern Ontario who are sharing knowledge well beyond their local communities, in some cases making connections that transcend international boundaries.

In addition to highlighting the potential of agrarian science, this chapter addresses the complex politics of science that inform the perspectives of the farmers I spoke with. Many of these southern Ontario farmers recognize the importance of scientific research while also being skeptical of its application by powerful actors. Living in a society where "science-based" (scientific) research is given high credibility, many farmers I spoke with struggled to reconcile claims-making that sometimes differed strongly from their own experiences. My research revealed that farmers critically reflect on the use of scientific claims-making as a tool of those in power. This was especially notable among ecological

farmers, but was also prevalent in the narratives of conventional farmers. Increasing mistrust of corporations, government oversight, and academic institutions, have contributed to an intensification in farmer-led research among the farmers that took part in this research. Engaging in practical experimentation and knowledge-sharing has the potential to empower farmers while increasing their resilience in the face of a changing climate

4.1. Agrarian Science

"Citizen science" (Irwin 1995)—research that is conducted by non-professional scientists, either independently or as part of an organized research project—offers considerable promise in addressing the concerns of environmental science and policy (Danielson et al. 2014). It has become a significant factor in ecological research and many large-scale projects have utilized "citizen scientists for data collection on climate change, invasive species, conservation biology, ecological restoration, water quality monitoring, population ecology, and monitoring of all kinds" (Silvertown 2009:467). In much of the literature surrounding citizen science, there is an emphasis on its contributions within larger research projects monitored by academic researchers, government, or industry (see Gilfedder et al. 2019). The type of scientific experimentation and research that I have observed within the farming community is sometimes coordinated with organized research projects, but much of it is farmer-driven. As such, the term "citizen science" is only indicative of a small fraction of the type of experimentation I have observed. I have chosen the term "agrarian science" to highlight the unique understandings and knowledge that result from interactions within ecology that occur as a result of agricultural labour. For the purposes of this dissertation, the findings and approaches that characterize agrarian science are meant to be understood as analogous to that which is often referred to in the academic literature as "local", "folk" or "traditional ecological knowledge". To clarify, agrarian science is an approach to knowledge acquisition whereby farmers experiment in their farming systems. The unique knowledge that results from this experimentation is cumulative and intersects with other knowledge acquisition resulting in complex understandings of ecology similar to

traditional ecological knowledge (TEK). I would argue that agrarian science should be understood as "science" whether or not it contributes to larger research projects, or whether the results are made publicly available. This does not mean that engagement with agrarian science should be approached without critical reflection. However, I wish to acknowledge that the processes of engagement that take place in agrarian science, in and of themselves, are valuable as modes of scientific inquiry.

When considering the role of "agrarian science" in helping to gain a greater understanding of relationships within ecology, there are a number of considerations. While there is a considerable body of research on the potential benefits of incorporating "local" knowledge in creating sustainable ecologies (von Glassengap et al. 2011; Shepherd 2010; Murray et al. 2006), I wish to emphasize the complexity of knowledge sharing and complicate the idea of the "local" with the reality that farmers are both sharing and incorporating knowledge from diverse sources and localities. This term was also chosen with the goal of disrupting the idea that this unique knowledge is learned and only applicable in "local" contexts. The knowledge that agrarian scientists have is the result of complex learning. It can more readily be thought of as globalized knowledge applied in local contexts (although it is often shared, modified and applied in non-local contexts as well).

The geographical areas of southwestern and south-central Ontario where I conducted my research, have been cultivated since time immemorial. The archaeological record finds evidence of Haudenosaunee maize agriculture in Southern Ontario as early as 500 C.E. (Warrick 2000). The view that agriculture spread to the prairies as a result of European colonial expansion is often perpetuated alongside narratives that suggest agriculture was promoted to First Nations from Europeans as a method of "civilizing" and integrating Indigenous groups into colonial society. However it was First Nations people who spread agriculture as a subsistence strategy to the prairies (Russell 2012:210). As understandings of pre-contact history largely rely on written and archaeological records, it is unknown how long agriculture has been a part of the subsistence strategies of the First Nations who live in what is now known as Southern Ontario. Oral history has

the potential to provide more nuanced understandings, however issues of ethics and project scope leave answers outside the purview of this research as research conducted with First Nations requires the development of relationships, the establishment of trust, and should include projects co-developed and in the interest of the community. What *is* known is that agriculture was a sophisticated and highly developed subsistence strategy. Polyculture practices of interplanting maize, beans, and pumpkin or squash (often referred to as the "Three Sisters"), resulted in increased nutrients and provided more food per person per hectare than monocultures of these crops (Mt. Pleasant 2016:96). Evidence of knowledge transfer and climate adaptation has been documented in the spread of new types of agricultural patterns from west of the Canadian Shield onto the Prairies at the beginning of the nineteenth century (Mt. Pleasant 2016:96).

My reasoning for including discussions of First Nations agriculture is to help illustrate the complexities of knowledge sharing that have shaped agriculture in southern Ontario. First Nations peoples capitalized on the richness of these lands long before colonization and were highly successful in cultivation. The subsequent success of colonial settlement requires an acknowledgement of the importance of Indigenous ways of knowing (which are diverse, which include Indigenous science and which reflect a diversity of lived experiences and world-views) and the willingness of First Nations peoples to share their knowledge of ecology and agriculture which was integral for early colonial settlers.

Similarly, farmers who have immigrated to the region from diverse localities bring with them distinct ways of knowing. In the context of agriculture, this means that their experiences within ecology reflect unique understandings which can then be built upon, modified, applied or discarded as they make sense of their local ecosystems. Many of the farmers I have spent time with are first generation Canadians. Their knowledge of farming, of soil, weeds, insects, fungi and pathogens, etc, comes from learning that occurred far from their farm ecosystem, but is applied, transformed, and built upon to create more nuanced and complex understandings of their local environments. Edward,

the ecological farmer I introduced at the beginning of this dissertation, discussed these processes of applying globalized knowledges in local contexts:

> It's here (climate change), but we've got to develop and find the plants. I find that a lot of the plants that were developed in Scotland do well here. Like I've got some tomato plants and stuff, and some of my onions [pause] they were developed in Scotland and they do really well here in this area. Better than some of the stuff that has been developed in Niagara or Leamington or the States. Even stuff from the East coast, the stuff from Scotland seems to do best here. I think that's something we've got to look at. Okay, we may need stuff from other countries because that is the climate we are becoming. Not keep looking local, look further afield and see if it will help.

These processes of sharing and integrating knowledge from diverse localities can also be seen through farm internship programs and interactions with migrant workers who have sophisticated knowledge from interactions within diverse ecologies. We can also see the potential benefits of globalized knowledge as farmers experiment with varietals from distant localities, and as farmers learn from others around the globe through engagement in online forums. As we can see, the processes of knowledge generation, transmission, and transformation often occur outside of local contexts. Implementation may be local, but the processes of knowledge acquisition are often global and highly integrated. As Edward revealed, capitalizing on these diverse knowledges and experiences may prove to be essential as farmers seek new ways of adapting to the distinct challenges associated with a rapidly changing climate.

Agrarian science, like other approaches to science, evolves out of complex interactions within ecology, including experimentation. Among the farmers I work with, innovation is a dynamic process that occurs not only as a result of necessary adaptation to challenges such as pests, weather, soil conditions, and economics, but also out of curiosity, creativity, and carefully observed experimentation. Farmers try new things, such as experimenting with new hybrids, or planting a crop they have never tried before just to "see what will happen." I listened to an organic farmer tell me in great detail and with unabashed delight about how she had been experimenting with cabbage, cross-breeding until she could achieve this wonderful version of a Kalibos cabbage with

beautiful variegated leaves and a deep purple heart. Another organic farmer I spent time with invited a group to see her test plots of grain. She had planted rows of wheat from all over the world including varieties from Ethiopia and Egypt. She catalogued and tracked everything carefully to determine which was doing best under the current year's conditions. Her efforts were a contribution to a farmer-led research project that was facilitated by an Ontario farm organization. She emphasized that these kinds of trials offered hope in the face of a rapidly changing climate. She suggested that farmers may have to experiment with plants from diverse localities to find suitable varieties that can withstand what may become a very different climate than the one they are growing in now.

Recently I visited a certified organic farm for a field-day where farmers were experimenting with pulses. They had planted ten varieties of edible beans including Jets and Zorro's, red turtles, and non-darkening pintos. When I asked the farmer what inspired him, he said "the rest of the world knows a lot more about edible beans than we do. It's time to learn." The farmers I spoke with communicated enthusiastically about the impetus behind their experimentation. A common refrain was "what would happen if we tried this?" Many farmers expressed that their experimentation was a source of joy for them. As one organic farmer who sells primarily at the farmers market described:

> We have 'loss leaders,' you know? Things that don't have to make money. If you didn't do that, it wouldn't be much fun, right? It's really important that you focus on the economics. I doubt you'll find a successful farmer that doesn't care about the economics. If you become way too focused on idealism, you usually will miss out. It's really hard to make enough money farming. But yeah, I mean, it's important to make sure you're having fun and sometimes the things you experiment with end up being successful and working out well. So every year we dedicate a certain percentage of our land and time to stuff that won't necessarily be profitable. It could be, but we don't know. There's always a little bit of research into that kind of stuff.

As farmers experiment in their farming systems, they sometimes engage with new methods and approaches. One farmer in Blyth, Ontario, for example, is growing tropical fruit, including bananas, in hoop houses. He heats the hoop houses with wood in the

winter and grows tropical fruit all year round. When asked about the driving force behind this experimentation he claimed: “We don’t have to be dependent on foreign countries to supply us our food” (CTV News Kitchener 2016). When asking farmers about what inspires them to try new things, another farmer put it to me simply: “I farm. I experiment.”

This kind of innovation, the creation of new hybrids, experimenting with exotic varietals, happens not necessarily because farmers have to, but because they can. Farmers explore different farming methods and they try new crop rotations. They use roguing and selection to develop new hybrids—roguing refers to the process of removing plants with undesirable characteristics from agricultural fields in order to select for the qualities that are desired. They experiment with different cover crops, try different pest control strategies, explore different methods of livestock husbandry and management, and employ creative marketing strategies. Farmers are not passive recipients of technology and knowledge. They selectively determine what will work best for them and are actively involved in the creation of new knowledge and technological innovation.

Plant breeding and experimentation is seen as essential by many farmers, as things that worked in the past may not always work, and there is constant pressure to appeal to market demands. Several of the farmers I interviewed and spoke with at a farmers’ market said that they watched prevailing trends and would experiment with things they had never grown before in anticipation of increased demand. As Adam (an organic farmer) and I discussed the necessity of experimentation in response to consumer demands, I asked him, “Do consumers’ demands and tastes change?”

> They do. We try to learn all the time. There are fads. I don’t think they change every year, but we’re going through a kale fad right now. It’s huge and um [pause] it’s smoothies. That started a couple of years ago already. I don’t know when it’s going to end. I don’t think it’s in its peak anymore, but we still sell a lot of kale. Like, more than we should and, um kale is great, but there’s better stuff than kale. In the middle of the summer we sell piles and piles of mature sized kale. Kale should be eaten now—in mid-November–December. It tastes better, it does better, but people want kale so we keep growing it all summer. They put it in their smoothies apparently. So that’s a fad (chuckles). Spaghetti squash—big fad. I wish

> it was easier to grow, but we sell a lot of spaghetti squash because of paleo diets. And I'm a big [pause] I hate fad diets, but I have to bite my tongue because [pause] as long as the fad diet includes some vegetable I can grow I guess I just have to keep my thoughts to myself (laughs). But anyway, spaghetti squash—people are loving it. Um, I don't know what the next fad is going to be. We try to guess. Selling a lot of rutabaga this fall. Yeah I didn't think that was a big one but we've got some unwaxed rutabaga and ours are really nice right now, so people seem to appreciate that. We're not big on them, we're not selling them like we're selling tomatoes, it's just [pause] you're surprised if you sell a bucket of rutabaga in one day, right? Because it's rutabaga, so, yeah, definitely I feel like there's trends and you get a little bit closer view on the trends because you talk to people.

Reflecting back on this particular conversation, I asked another farmer (ecological) about how he navigates changing dietary trends. As we walked along the trail between his fields I mentioned that there had been a lot in the news about quinoa. I asked him why farmers in southern Ontario were not growing it since there was such an obvious demand. His eyes swept the ground and he turned and bent down to his right. When he stood, he held a wispy weed in his hand. He held it out towards me and asked me: "do you know what this is?" I admitted that I didn't. He told me it was Lamb's Quarters and this weed could be found everywhere throughout southern Ontario (see Image 3). He asked me: "do you have a garden at home?" I said that I did not grow any vegetables at home, but that I enjoyed my flower gardens very much. He said, "next time you're weeding, you look and you will find this plant in your garden." I felt like maybe we'd strayed away from our earlier conversation, but then he said "and this here plant is why we don't grow quinoa in Ontario." I asked him to elaborate and he explained that Lamb's Quarters is closely related to quinoa and is also edible. He explained that as the weed is so ubiquitous in southern Ontario it meant that farmers who wanted to grow quinoa could not maintain the quality of their crop because these plants were "promiscuous" and would just keep cross-breeding. I was fascinated. As farmers interact with diverse species within ecology they inevitably learn a great deal about the unique interactions that occur between different species.

Farmer innovation happens through experimentation with different crops and methods. I took part in a field day that was attended by a number of farmers (including

Figure 3: *Chenopodium album L.*—Lamb's Quarters, a highly edible plant and ubiquitous weed in fields and gardens throughout southern Ontario.

conventional ones). The field day took place on a 200 acre organic CSA farm where the farmer uses horses rather than heavy equipment (see Image 4). The farmers who attended believed they could benefit from learning from other farmers about crop rotation and cover crop strategies. One farmer discussed his experimentation with cover crops. He said that the previous winter he had tried winter wheat and that it was very successful. However, he declared that he was going to try red clover this year as a method of comparison. This type of experimentation is important and highly personal. One method or strategy may work well for one farmer and yet be considerably less effective for another. The health and quality of a farm's ecology is highly individualized. In fact, some farmers explained that you can have very different soil qualities and attributes even on the same farm.

Figure 4: Draft horses working at a biodynamic farm. Photo by Author.

Another farmer who attended the field day discussed experimentation with cover crops and how he had learned about their potential in mitigating the risk of erosion:

> There are a lot of farmers focusing on cover crops right now. Really interesting stuff. There's one conventional farmer I know, and he plants these cover crops that are like three feet high and he plants corn into it. He only kills the cover crop a day or two before planting and it just looks like a mess. It looks like a big cow pasture or something. You think, "wow, this is just going to be a disaster" but then everything starts to die and you start seeing these corn plants popping through. And if he can make that work every year, that's going to be a big way of moving forward I think. Because there's a lot of fields, they get worked in the fall, they look nice and smooth and level and they get a couple of big rains in the winter time when the ground starts thawing and that's when you get lots of erosion—when the ground starts to thaw. The ground is frozen underneath and the top layer is mud and

> you get a big rain and that top layer just washes right off. Off that frozen ground, off that frozen layer. I think they call it sheet erosion.

When discussing experimentation, a number of farmers expressed their beliefs in the usefulness of exploring new hybrids and varietals, especially in the context of enhancing resiliency to climate change. The overwhelming adoption of conventional methods of agriculture has led to a decrease in this type of experimentation. As farmers have invested in high-yielding seed varieties promoted by corporations, they lost the ability to save seeds due to patenting laws. The uniformity and quality of the products meant that many soon abandoned the practice and embraced the new technology. As Lukas described,

> If you bought into the GMO system, you're in that system now. There's no seed saving. It's been an evolution from hybrid corn because pre-1940s all corn was open-pollinated. So you could save your own corn and then plant it again [pause] save the best cobs and then use that for seed for the next year. And then when hybrid corn came out it yielded so much better than open-pollinated and it was so much more consistent, farmers just stopped using open-pollinated corn slowly but surely. But, uh [pause] except for a few hardcore ones that kept it going for awhile but you can still buy it from a few farms around Ontario. But everyone grows hybrid corn now except every year you've got to buy seed. So now with the Roundup Ready soybeans[14], it's the same thing. They've accepted now that it's just the cost of doing business. I've got to buy my seeds every year and the weeds are easy to control because of the Roundup and now weeds are becoming resistant to Roundup. So now they've accepted that [pause]. Well now you've got to add a few mixtures of chemicals now to the Roundup to make it work better, and they've just accepted that.

Although many conventional farmers do take part in experimentation with other crops on their farms (such as vegetables), or with diverse methods (such as cover-cropping), farmers who cash-crop[15] are heavily invested in the conventional model of purchasing seeds. Cash crops such as corn, wheat, canola, and soybean are also Canada's biggest agricultural commodity exports and command the largest portion of land use in

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[14] These are soybeans that have been genetically modified to withstand applications of Monsanto's toxic pesticide—Roundup.

[15] Cash crops are able to be farmed on a much larger scale than vegetables and are particularly suitable for large-scale agriculture. Some popular cash crops in Ontario are corn, wheat, barley, canola and soybeans.

agriculture. This reality has some farmers worried about vulnerability. Farmers have already seen an increase in pest resistance to certain chemicals, as well as the emergence of "superweeds" that have evolved resistance to glyphosate (Roundup). Glyphosate resistant weeds now affect hundreds of millions of acres world-wide, including in the U.S. and Canada, with crop losses at around $1 billion in the United States alone (Bain et al. 2017:211). As noted previously, several farmers I spoke with are worried that they have "put all their eggs in one basket" and are making attempts to revive the biodiversity of Ontario's agricultural sector by experimenting with crops they have never tried before. Some are innovating by reintroducing crops that have been grown successfully in the past by experimenting with "heirloom" seeds. Heirloom seeds are marketed as open-pollinated (pollinated by insects, birds, wind, or sometimes by humans), and are often the result of seed-saving that has been passed down over generations. Some of these varietals are close to extinction and experimentation has the potential to revive many of these crops while preserving genetic diversity. There are certain farmers and organizations that are integral to these processes. Seeds of Diversity is an organization that works with farmers and other growers to cultivate heirloom crops and plants that are close to extinction. Their mandate includes encouraging farmers to grow, exchange, and distribute seed varieties as well as educating the public on the importance of these practices (Seeds of Diversity 2019).

Aster, who identifies herself as a new farmer, had relocated to Ontario from Vancouver after inheriting her land from her mother. Her mother had never taken part in agriculture but had chosen to purchase the farm in the hopes of enjoying a country lifestyle after retirement. Aster does not farm her own land. She rents out the majority of her acreage to a neighbouring farmer. However she experiments and saves seeds for an organic seed seller. I asked her how this process works. We walked around her farm on a gloriously sunny Wednesday morning, and she pointed out the various plots where she was growing a diverse number of vegetables and herbs. She spoke very positively about the experience:

> We ask her (the organic seed seller) what she wants and we let her know what we would like to do. Like, I'm a cook. I love cooking. So I asked for basil. We did Genovese last year. This year it's some purple thing. Amish paste tomatoes. So if it's what she wants grown, obviously, but we do some strange crops. (pointing to a straggling plant growing in the garden) I don't even know if these will ripen properly.

Consumers are currently enamoured with the idea of heirloom varieties, and at farmers markets where rainbow carrots are available, there is certain to be demand. However, embracing the possibilities of heirloom varieties requires some caution as there is vulnerability too. Farmers are quick to embrace experimentation if it will also be profitable, and while many farmers are acutely aware of the benefits of reviving the genetic diversity within agriculture, they must also make a living. Currently, the growing of heirloom produce is trendy and highly profitable, but what happens if there is no longer consumer demand? Farmers may abandon their commitment to reviving heirloom and threatened varieties if the pursuit is no longer profitable, so while this offers important opportunities for reviving some genetic diversity it should be viewed as a small contribution to combatting the very large problem of biodiversity loss in agriculture.

When discussing the importance of seed saving at the Guelph Organic Conference, an older farmer stressed that we "need to be growing, not saving." When I asked him to elaborate, he brought up the realities of coevolution. Coevolution can be understood as the processes whereby: "recurrent interactions between species are thought to generate coevolutionary dynamics such that, as one species evolves, selective pressures on the other change, eventually leading to genotypic changes due to reciprocal selection" (Arbuckle et al. 2017:119). We discussed the Svalbard Global Seed Vault in Norway which claims to hold the largest collection of crop diversity. This farmer suggested that this was all well and good, but if we are not growing those plants, their genetic diversity may not have the answers we need. He stressed that plants are always changing in response to their interactions with the rest of ecology. Genetic diversity kept in vaults may offer some potential solutions, but it also may not. He strongly believed

that we need to be growing more diversity so that plants have the opportunity to coevolve within the changing dynamics of ecology.

Although farmers in southern Ontario have yet to experience the devastating adverse weather events that have affected farmers in other parts of the world, the farmers I spoke with are acutely aware of the risk. As Edward put it, “I can see, personally, we’re not going to have Florida to produce vegetables and California is pretty washed up because of their water problems. So we’ve got to get on to it and starting growing more of our vegetable crops up here. We may have to do it in hoop houses or whatever, but we’ve got to be doing that.” Experimentation is a key part of farming, but this can be risky and farming is already a risky endeavour. Farmers seek to mitigate risks of crop failure whenever possible because their livelihoods depend on it. For some farmers, innovation and experimentation involves more than just deciding which crops to grow, or which methods to use. Some prefer to diversify their economic portfolios by exploiting opportunities of both direct marketing (selling at the farm gate or at farmers markets) and contracts. Other ways to diversify include offering public tours, investing in green energy, and getting involved in tourism by offering retreats. I spoke with farmers who engaged in each of these types of diversification. One farmer had installed solar panels, while his brother-in-law had wind turbines on his land. Another farmer welcomed elementary school children annually.

As farmers take part in these diverse methods of experimentation, how they share the knowledge they gain from these endeavours varies greatly. Many farmers that I spoke with did not like taking part in formal research projects. The most common reason given was that they just didn’t like the paperwork. Several farmers stressed that they just didn’t have the time to devote to careful documentation and monitoring. This can be a source of frustration for farm organizations that encourage farmer-led research and who seek out farmers who are willing to participate in trials. Most of the farmers that I interviewed were very enthusiastic about these projects. Some admitted that they had signed up and planted the crops without following through on their responsibilities of recording their observations. A few farmers even admitted to filling in the forms at the end of the trial,

basically fudging their observations or basing them on memory because they were just too busy to attend to the processes of research in the ways expected by the leaders of these projects. Many were able to recall orally what went well and what didn't with these trials. They reported that they were happy to share their knowledge through more relaxed and informal venues, such as at field days, but that the demands of formalized research were an extra burden when they already felt stretched thin.

Other farmers were much more invested in the sharing of knowledge. Some prepared presentations for agricultural conferences and would travel considerable distances to share what they had learned. Others would share information during union local meetings. I spoke to a farmer from Manitoulin Island who published a book based on his experiences with ecology. He wanted to share some of the knowledge he had gained over a lifetime of farming. The Ecological Farmers of Ontario also published a book that was a culmination of a number of farmer-led research projects and included interviews and information provided by a number of organic farmers who wished to share their knowledge. These endeavours required a considerable amount of commitment and time invested in order to bring these projects to fruition and allowed for wider dissemination of farmers' experiences within ecology in Ontario.

Whether it is through more formalized dissemination, or casual farmer-to-farmer transfer, much of the knowledge gained through experimentation and innovation finds its way back into the farming community and then is evaluated, built upon, integrated, or discarded. Like other farmers around the world, farmers in southern Ontario have a particular form of knowledge that has developed due to their intimate interactions within ecology, sometimes over generations. This knowledge is comparable to more formal scientific approaches as it develops as a result of the incorporation of diverse knowledge sources, as well as through experiential learning and taking part in practical experimentation. Agrarian science offers the potential for more nuanced understandings about the particularities of ecological relationships, especially pertaining to issues of agricultural adaptability, environmental sustainability, and the maintenance of biodiversity as it stems from sustained interactions within particular ecosystems. This

form of long-term engagement is not typical of more formal scientific engagements such as those that occur in academic research where budgetary and time constraints often limit the ability of scientists to partake in sustained research in a single locality. Anthropologists are often notable for their commitment to sustained research encounters among communities, but even intensive, long-term fieldwork would likely not provide the same level of understanding that farmers gain from their lived experience and the knowledge transfer that occurs among farmers, sometimes over generations.

The important contributions of more systematic forms of scientific research are not in dispute, however agrarian science offers specific advantages for enhancing our understandings of complex ecological processes. Recent scholarship acknowledges the unique form of knowledge held by agrarian citizens and other harvesters around the globe (see Altieri et al. 2012; von Glasenapp and Thorton 2011; Murray et al. 2006). The contributions of citizen scientists have been important in creating more nuanced understandings of biodiversity including “species distribution and population abundance, species traits, and ecosystem function variables” (Chandler et al. 2016:280). Agrarian science also offers the potential for more longitudinal observations of relationships within ecology which can help enhance our understandings of complex systems and processes. The realities of more formalized research, such as that conducted by academic researchers and institutions, is that this research is often constrained by time and funding variables leading to “fast, competitive science" (Stengers 2018:101). This is an issue I will return to later and one that has implications for how we make decisions about what science “counts”.

Although farmers in southern Ontario have often received an education that privileges formal or academic science, many of the farmers I spoke with admitted to being skeptical of the emphasis on scientific and technological approaches to the management of agricultural systems. This was not due to some nostalgic notion of agriculture as it was done in the past, but an acknowledgement that the confidence with which governments and industry proceed in the name of scientific certainty is cause for concern. Discussions surrounding the emphasis that legislators place on scientific

knowledge created lively debates about the subjectivity of scientific claims. These discussions reveal the tensions many farmers feel as a result of the increasing corporatization of agriculture and have enormous implications for the integration of new knowledge and for how farmers engage with narratives surrounding sustainability.

4.2. "Science-based"—the New Religion

Some of the tension that has arisen in the farming community about which methods of agriculture are sustainable centres around discussions of science. Most of the farmers I spoke with had a great deal to say about how science is leveraged by corporations, governments, or special interest groups in order to further political aims. Many were critical of the funding structure that has seen a decrease in publicly funded research and were suspect of research paid for by big business. A number of farmers also pointed out the limitations of current scientific frameworks when it comes to understanding issues of ecological concern. The division between conventional farmers and organic, biodynamic, or ecological farmers was apparent in these narratives as each called upon different scientific discourses to reinforce and justify their choices in farming methods. As Margaret, an organic farmer, declared:

> I mean it's such a line, this "science-based evidence" (laughs). Because it's kind of like it's the gospel of [pause]. The editor of the Rural Voice wrote something in an editorial recently about "science-based is the new religion" and he's right (laughs). He's kind of like "this is my science-based, this is my religion and mine's right and yours is wrong" (laughs). Science is never absolute. At the same time we've got, pulling support for public science, done for the public good and in the public's interests, which should be [pause] of course it's never neutral because of course science is never neutral, but it has the potential to be more neutral than science funded by the corporations.

As I discussed the impact of pesticide use on ecology with a couple of conventional farmers, some predictable narratives emerged that emphasized the scientific evidence surrounding safety. I say "predictable" because discussions surrounding genetically modified organisms (GMOs) and the use of pesticides often rely on declarations of safety based on scientific evidence in the form of numerous field and laboratory tests. At a university conference on agricultural sustainability I engaged in a

heated discussion with a biologist who claimed to work for a major seed corporation. I overheard this biologist verbally berating a middle-aged woman who was manning the booth for the Canadian Biotechnology Action Network (C-BAN). This biologist was emphatic in her belief that the science proved that GMOs are safe and anyone who said otherwise was just fear-mongering. I inserted myself into the discussion to the apparent relief of the woman manning the booth. I first acknowledged that the meta-data surrounding genetic modification declares the process to be safe for animal and human consumption. I then challenged the biologist to think more broadly about her definition of "safety". I pointed out that the vast majority of GMOs were developed to withstand applications of Roundup, a pesticide with high toxicity that binds itself to water molecules making its persistence within ecology concerning to environmentalists. I pointed out the detrimental effects of monoculture in the form of biodiversity loss. I explained the disastrous effects of the introduction of GMOs in both Mexico and India, that led to economic and biological devastation. I asked her to consider, within this broader context, whether she could still argue that GMOs were safe. She remained firmly entrenched in her belief and declared "I feed them to my children. If I did not believe with all my heart and soul that they were safe, I would never do that." She then went on to blame farmers for their over-application of Roundup as the determining factor when it comes to detrimental effects on ecology.

Interestingly, Lukas, the organic farmer discussed earlier who sells his pork to China, described similar interactions with pro-GMO advocates, including professional scientists. His own position was informed by critical engagement with scientific discourses and he felt comfortable challenging the science put forth based on his own understandings and experiences. He explained,

> Getting down to the truth on matters is actually difficult nowadays. It's amazing with all the information we have fed to us, we still can't get to the truth. I like to debate scientists on Twitter sometimes and some of them, um, they claim to be scientists and science-based and so on, and then they always like to back up all the things they say with references, right? And a lot of these references, I always ask them, I say "well can you really use the EPA as your reference? The Environmental Protection Agency as your reference?" I'm like, they're totally political. I mean

> [pause], you know what I mean? You can't use that as a reference. I said the only thing you can look at is what's really happening at the ground level. Because one scientist was saying—she was promoting GMOs, so she was saying GMOs make a cleaner, healthier environment. I was like, "how so?" It's like the Mississippi River is full of nitrates, and the lakes are full of phosphates, so how do GMOs help that? She says, "well it's not because of GMOs". I was like, "well it's part of the whole picture," you know? It's uh [pause] you just can't not blame one versus the other. You said in your claim that GMOs help the environment. Well if you look at what's happening in the world, the environment is not getting better in agriculture. So you can't really say that. But they like to twist things around that way, right? So you really have to be sharp to see through that. And that type of thing, so [pause], so I tell these scientists, I'm like, look I don't care what study you're referencing, go look for yourself and go see what's really happening and then you really know what's happening.

As I spoke to conventional farmers about this issue, many called on similar narratives to reinforce their choice in farming methods. Julie, the seed seller and conventional farmer, felt strongly that GMOs are safe. She declared:

> What's good for the animals is good for us too, or if I'm growing something in the field, I want to be able to eat it too. I have to feel safe with what I'm doing. I'm not going to grow something I don't feel is safe to eat and then sell it my neighbour. That would be horrible! And as far as our vegetables are concerned, none of that is GMO.

Julie also relied on another common narrative that surrounds GMOs—the idea that corporations are just engaging in the same sort of plant breeding and manipulation of genetics that farmers have done for generations. She envisions these processes as enabling farmers to take advantage of science's ability to advance things more quickly. However, she was also quick to point out where her enthusiasm for technology begins to wane:

> The process has sped up like crazy. It used to be you would take 15 years to come up with a new corn or a new wheat or anything, because you would grow it and you would have this variety here and this variety there and they would cross-breed and you would get a stronger strain. Now they can speed everything up because of technology and chemistry they are able to do that faster. It doesn't take nearly as long because they are able to do that. But I don't think that's bad, but at the same time there are extremes. Where they want to start cloning animals and things like that. That is way, way beyond what is natural.

Helen, another conventional farmer, acknowledged the inherent problems when research is funded by business. However, she also referenced this same research to insinuate that her crops were safe because the research showed that there were more pesticide residues on people's lawns than there were in a conventional field. She described it this way,

> Scientists, they're paid by companies to find out certain things. Like we had a friend and he was this research guy and he did some studies on a couple of sprays and he was measuring pesticide residues. And his place was in the city and he was measuring pesticides on the plot that he sprayed them on, and then he went ahead and started measuring on people's lawns, and he said there was more pesticide residues on people's lawns than on a standard field. This was before the pesticide bans. But the other thing [pause], one time he did this study, and the company that paid him to do the study said "we can't publish that." Why not? "Because it doesn't say what we want it to."

Robert, an organic dairy farmer, was openly critical of conventional farmers that could not think critically about the obvious conflicts inherent in relying on research that has been funded by, and benefits corporations:

> Big companies like Monsanto are like, "Well if you don't use it, the neighbour is going to use it and put you out of business." They didn't care. All they cared about is the selling of that drug. The consumer is too stupid. They're going to drink it (milk) anyways and say it's safe. "We've proven it. We've got paperwork" (laughs). Okay? "Oh, the other paperwork is wrong. My lawyer will tell you that." It's hard to believe the conventional farmers are so convinced. Well, my nephew is a perfect example: "Well I went to college for two years to teach me how to do chemicals and damn it, they said it was safe, so I'm going to do it!" (smashes hand on table for emphasis). And he's adamant. When he says that he's adamant about it. He believes it. And he thinks I'm an outright moron because I have weeds in my field and 20% less production. But I get a 200–300% extra profitability, so I'm the moron? (Chuckles)

My experience is that the organic and ecological farmers I spoke with were more skeptical of scientific claims-making, especially within the context of its use by powerful corporations and governments who use scientific discourses to declare certain technologies safe, often while relying on testing done by the corporation itself. These farmers were more apt to situate scientific claims-making into larger discussions of

politics, economics, or philosophy. As conventional agriculture is still heavily promoted by corporations, and governments, while being declared by the majority of farmers in Canada as being safe and profitable, it makes sense that farmers outside of this system would question the science that promotes these methods. Their identity as farmers outside of the dominant system relies on leveraging alternative discourses, and many of these farmers spoke of the discrepancy between what they had been told about ecological farming methods (that they are risky and less productive) and what they had experienced in practice. These same farmers also suggested that if conventional agriculture was the ideal way of growing food, as it is promoted, organic and ecological farmers would not exist. The fact that there is an alternative, and one that is vocal and politically-charged, suggests that conventional agriculture is not all it is promoted to be. Liam, an organic dairy farmer who had started out conventional, described his feelings:

> I'm concerned about science. Science is the same as the voting structure—stuck in the 50s, and they don't want to move on. And the organic farmers can show to you that there is something wrong with the science. Otherwise, we wouldn't be here. If the science would be right, there would be no organic farmers because they would be broke. They would be out of business and the cows would be all dead. So something is wrong with the system. And that's the problem we have. It's corporate driven. That's the problem. The corporations make the rules and not the people and not the government. The government has nothing to say.

Liam went on to describe how his experiences with dairy farming changed as his methods changed. He revealed that he had experienced difficulties with the health of his herds and poor birth rates, which he ultimately attributed to their exposure to chemicals. He described the changes in his cows after transitioning from conventional agriculture to organic:

> Why would you go and let all these weeds grow when you can spray and have everything clean? But when I saw what happened to my cows after we stopped using all that stuff [pause] that was just amazing. I didn't want to have cows anymore. I went to organic crops to make a living, but I didn't want cows anymore. I thought I would just transition and then not have cows anymore. But over the three years, the health of the cows improved so much, I thought there must be a connection. Using all the fertilizer and all the spray [pause]. I went on all these tours, learning about all this stuff and they all said the same thing—when you stop

> using all those chemicals, the health of your cows will improve. And I couldn't believe it. But when you go through it yourself, boy oh boy. Just stop using all that stuff.

Once he transitioned to organic Liam also changed his animal husbandry practices. Like many farmers, Liam had formerly made use of a camera installed in his barn to monitor when cows were calving. He would then go out to the barn in case the cow needed help with the delivery. After transitioning to organic, he was in a mindset of change and decided he was just going to "let cows be cows". I asked him to elaborate and he said he stopped isolating the bulls, allowing all the cows to be in the fields and barns without isolating the males to control breeding opportunities. He also unplugged the camera in the barn. He claimed that the difference in the health of his herd was remarkable. He had lower incidents of disease, higher pregnancy rates, and healthier calves. He had a twinkle in his eye when he declared to me with undisguised sarcasm: "Imagine that? We let the animals decide for themselves when they want to breed and allow them to give birth to their young without interference. How do they get along without us?"

There was some convergence among farmers of different orientations when it came to discussions of raw milk. There was consensus that raw milk is safe and many farmers said that they drank milk directly from the cow on a regular basis. They blamed corporate influence and poor government engagement with the science concerning risk assessment in the food system. Liam and I discussed the risk of drinking unpasteurized milk in the context of current food recalls and outbreaks of listeriosis and e-coli in the food industry. He emphasized the inherent troubles in a system that repeatedly issues recalls for food contamination, but bans a practice that farmers have in engaged in for thousands of years. He described it this way:

> It's industry driven and they want to have the full quick [industry wants to make sure they are capitalizing on profits whenever possible]. A lot of people who go to the markets now would like to buy raw milk, but they can't. If you look at the research, the research is old too. Why can't they do new ones (research)? And not hang onto that old stuff all of the time. There will never be zero risk. Not even with pasteurized. The risk of drinking raw milk is very, very, small. That's my view. There is research out there that will show you that raw milk will kill pathogens.

> Good bacteria kills pathogens in milk if you leave raw milk in the fridge for a few days. Nature took care for so long…it works.

Gertrude, a conventional soybean farmer, felt similarly about the safety of raw milk:

> We used to drink milk straight from the cow. Didn't hurt us any. You went to the barn and you came back in with your bucket of milk. People have been drinking milk that way for thousands of years. We have many ethnic people who come here and ask us if we know any farmers who will sell them raw milk and we tell them it's illegal here. We could send them but [pause] so we're not giving out names. It's illegal so why would they want to bargain with a person? So you don't give out any names, but….

Robert spoke frankly about the realities surrounding raw milk and the fact that despite its illegality, there is consumer demand and farmers willing to supply it. Like Liam, Robert blames the influence of corporations and their pursuit of profits in shaping the marketability of raw milk. He believes it should be regulated, but that it is certainly safe. As he described it:

> Big corporations are leading the charge to ban—they use 'health' as the excuse. It's a good excuse, but the reality is the big corporations just want their cut. They don't want people taking profits away from them. But it happens. People, theoretically at my back door, definitely at the Mennonite communities, ask for and receive raw milk. It's hidden but it's there.

The influence of corporations was a common refrain among farmers who were critical of scientific research. Most were skeptical of the validity of research that had been funded by big business and whose results obviously served to reinforce the financial interests of corporations. A number of farmers were very concerned about the influence of large multinational corporations on our education system and the implications of this for future sustainability. Speaking specifically about the influence of corporate agriculture on the University of Guelph, Robert said:

> The big Monsantos of the world, have got so much control over Guelph, you know? They basically [pause] and this has happened down in the States [pause], if you support an organic program we'll yank our funding from you. That's a regular thing down in the States. If you send this paper out saying you had higher yield in organic than the conventional yield, we're going to yank all our funding from you. That's a common thing. That's not uncommon. That's a very common thing. And

> see I really do think research should be coming from an independent source. Not from big corporations, they only do things for profit. Big corporations are designated for profit at all costs - legal or non-legal - their job is for profit. So [pause] that's little things like that, they have kind of dragged and pulled me towards the philosophy.

Margaret had similar concerns about the influence of powerful corporations on research. She described her apprehension:

> I already knew when I began looking at universities that Guelph had nothing I want [pause]. As long as we tie our research to [pause] research dollars to uh [pause]. You can't get public research dollars unless you get corporate research dollars, or some sort of private research dollars, well who has the money? Obviously someone with something to sell.

What a number of ecological farmers had in common was a more critical engagement with the politics of science. Several farmers recognized and commented on the limitations of specific scientific approaches. Margaret said:

> I learned in my first year stats class, it was one of the most important things to learn because [pause] that you can use statistics to prove whatever it is you want to prove. (Laughs) They can be manipulated, so, so that's you know, right there, any thought I would have had that science is unbiased, I knew from then on that it was never unbiased. People don't see that.

She discussed this issue expansively because she thought it was particularly important. Like many other farmers that I spoke with during my fieldwork, Margaret was concerned with how science is manipulated to advance the interests of powerful actors—often to the detriment of ecology and humanity. She emphasized her belief that scientific research itself is extremely important, but that we need to recognize its limitations and its malleability under the influence of specific corporate and political interests. Margaret also advocated for a broader understanding of science to make room for the contributions of agrarian science. She described her thoughts:

> It's not that I don't think that science is [pause] I do think science is really important and research is [pause], but I mean scientific research can all contribute to our knowledge, but it won't necessarily. So it's, [pause], and it's never neutral. When I'm looking at something, I come with my own biases when I'm looking at

> something like a scientific journal. I come at it with my own bias. I know that. But I mean, this "let's accept the experts" when you don't think they have a bias [pause] I mean (laughs). And public policy needs to be drawn from more neutral ground than it is. You know that's one of the things that I'm hopeful the Ontario government realizes who they need to talk to. I'm somewhat hopeful that they realize that science-based decisions involve more than looking at a broader cross-section of science than what we have been doing. I mean, if we come to any move towards restricting he use of neonicotinoids in Ontario, which maybe we will and maybe we won't, if we do it will be because we have a government that was finally willing to look at a broader cross-section of the science that's out there, because too often we're just looking at too narrow, and setting public policy looking at way too narrow [pause]. And at the same time we're getting rid of the public support for what could be done in a more neutral way for the public interest. They don't take a precautionary approach at all. We pretend we're consulting the public, but we consult the lobby groups for the chemical companies, or we consult the big farm organizations that are also [pause] that's the thing—farm organizations are, most of them also get significant amounts of funding through sponsorships or whatever, from the chemical companies. Consult the stakeholders. Well the stakeholders are the ones that have an economic interest, not the public. We ought to be consulting the public. That's a little bee in my bonnet these days (laughs). Actually it always has been.

As we discussed her concerns about science, I asked Margaret if there was anything else she would like to say on the issue. She said:

> Mostly I'd like people to know that science is not neutral (laughs). I mean there's a difference between knowledge and science and technology, you know? Farmers, we have our knowledge as organic farmers and we also have our knowledge as farmers. And uh, it's really important—that knowledge—and every time we, you know, have fewer farmers, we lose that knowledge. Every time someone who grows up on a farm and disappears from a farm, we actually end up losing a lot of knowledge. It's knowledge that just accumulates over years and years, generations and generations, and when you get that break you know [pause] and I think that's why when you get newer farmers that haven't grown up on-farm they need that more step-by-step guide because they don't have the generations of knowledge to uh (pause) they haven't grown up with the stories of "this is what happened in 1936" (laughs). Oh my dad used to tell me "this is what happened in 1936 and this is what we did…" And I still remember 1952 and ….(laughs).

Margaret's comments reinforce what I learned throughout my fieldwork—that farmers have a unique form of knowledge that results from their interactions in ecology. Agrarian science combined with complex exchanges of knowledge and other forms of

experiential learning, are highly valued in the farming community as a distinct form of expertise. How farmers categorize and make sense of different forms of knowledge is closely connected to identity. Individuals will align with research and knowledge that is easily incorporated into their worldview and which reinforces their values and beliefs about what it means to be a "good farmer." As farmers sift through competing scientific claims they must evaluate and decide on the validity of the claims being made and whether or not the information (in whole or in part), should be incorporated or discarded. These decisions are highly personal and while this "struggle is primarily fought using the language of science, other factors, including attitudes towards markets, uncertainty, and intrinsic values underlie the debate" (Campbell 2011:49).

Through my research it became apparent that farmers of diverse methodological orientations leverage scientific discourses in distinctive ways to reinforce their decision-making and enhance their marketability. The conventional farmers I spoke with replicated scientific discourses that claim the safety of biotechnology and pesticide use, and the importance of high yields in feeding a growing world population. These conventional farmers also often reinforced ideologies about the inherent value of scientific and technological advancement. In contrast, the farmers of more ecological, biodynamic, or organic orientations more readily engaged with scientific claims-making from a critical perspective, pointing out discrepancies between certain scientific assertions and their own experiences within ecology. These farmers also readily engaged with scientific discourses or research that reinforced their own politics and experiences, using this research as a means of reinforcing their beliefs that competing science "got it wrong." Many of these farmers leveraged environmental politics in ways that enhanced the marketability of their production. Although I have created categories of distinction here, these are based on generalities and many farmers would not fit neatly into either category. Most of the farmers I encountered were openly critical of the integrity of scientific research based on concerns over the influence of powerful actors who fund research while being politically and financially invested in its outcomes.

Farmers in southern Ontario must navigate between the necessity of growing food for expanding global markets, while facing increasing pressure to be sensitive to the environment and improve their resilience in the face of climate change. As they struggle to make decisions about what modes of agriculture are "best" they must find a place among competing scientific claims about what agricultural production should look like as they move into an uncertain future. The farmers that I spoke with during my fieldwork are increasingly looking to one another for solutions to try to determine if agrarian science offers solutions that more formalized science does not. As they engage with diverse sources of knowledge they must make decisions about which knowledges are valued and determine what defines expertise.

4.3. A Politics of Destabilization—Experts in the "Field"

Many of the criticisms levelled at "science-based" research by farmers are worthy of serious consideration. Forsythe and Walker (2008) discuss how "dominant environmental narratives often depend on simplified characterizations of ecological systems that are far more complex and uncertain than assumed" (in Bassett and Peimer 2015:160). This tendency toward reductionism and oversimplification is highly problematic when seeking to address such complex challenges as the relationships within ecology that contribute to climate change. As Rigg and Mason assert: "the tendency of modern science to reduce complex phenomena into their component parts has many advantages for advancing knowledge. However, such reductionism in climate science is also a problem because it narrows the evidence base, limiting visions of possible futures and the ways they might be achieved" (2018:1030). Lorne, an ecological farmer who contributes his expertise by volunteering on an experimental farm, described his perspective on some of the limitations of academic science. He explained:

> I've tried to explain it to the biologists, but they don't seem to get it. I tell them, 'you can't do soil science in a lab.' They just keep doing what they're doing. They don't listen. You can learn some things about the soil by putting it in a test tube and taking it to the lab. Of course you can. But there's a lot you can't know when you take it out of context like that. Soil is alive and its composition is different

> depending on things like moisture, wind, and plant matter. It changes. Understanding that matters.

Farmers have important information to contribute to our understandings of ecology. When it comes to an analysis of what is happening in the specific ecologies of their farming systems, agrarian scientists are the experts in their "field". Through their work, farmers interact closely with ecology and gain unique understandings based on their diversity of experiences. The sample of farmers in southern Ontario with whom I worked, certainly, are participating in practical experimentation through planting a diversity of crops and taking part in trials that include seeds and plants from all over the world. They are expanding their knowledge base through trying out diverse methods (such as cover-cropping) and evaluating how these shape the success of their production. Some farmers are engaged in plant breeding and saving seeds, providing opportunities for other farmers to experiment with their varietals through seed exchanges to help determine what plants grow best under current conditions. These types of interactions offer important avenues for understanding what is happening within ecology as a result of climate change. Similarly, an increase in farmer experimentation, especially with crop diversification and a revival of agricultural diversity offer important opportunities to enhance adaptive capacity in the face of an uncertain future. Although farmers have always done this to some extent, we are currently seeing a revival of these practices at least among the farmers who contributed to my research. In recent decades, much of the impetus behind these practices has been lost as a result of adherence to an industrial agriculture model that values uniformity over diversity, making the revival of these practices even more notable. Agricultural modernization has also disrupted farmers' relationships to the rest of ecology as the move towards mechanization means many farmers who engage in industrial agriculture spend much of their time up on tractors, on planters, or on combines. As one farmer described it to me:

> Farmers used to always be on the ground, in their fields. They had to rogue and select the best plants to save seeds for future plantings. Now, many farmers spend much of their time up on big equipment. Many of these new vehicles have GPS. The farmer barely has to steer! I know farmers who take their iPad up in there.

> Those farmers aren't in tune with what is happening on their land. That's a big difference.

Through my research, it has become apparent that farmers in southern Ontario value the experiential knowledge that is gained through their interactions in ecology. Overwhelmingly, farmers showed a preference for knowledge based on their own, or other farmers' experiences and insights. As farmers contend with climate change as a new reality with specific social, economic, political, and ecological challenges, they continue to turn to one another for answers while governments and industry continue to propel us down the path of destruction. Appeals by many farmers to listen to what is happening at the ground level are often ignored despite a growing body of research that shows the potential value of including citizen science in our understandings of ecology.

In *Knowing Nature: Conversations at the Intersections of Political Ecology and Science Studies,* Paul Nadasdy and Tim Forsyth (2011) present case studies which illustrate that place-based understandings of ecology are "likely to be more nuanced, historically informed, multifactorial, and meaning-rich than those imposed from above by short-term, superficial scientific engagements" (Turner 2011:302). Science conducted by non-specialists has provided important insights into ecological and environmental issues (McKinley et al. 2015). However, "despite the wealth of information generated and the many resulting scientific discoveries, citizen science arouses skepticism among professional scientists" (Kosmala et al. 2016:551). As Isabelle Stengers notes, claims of "rationality and objectivity…have been instrumental in silencing voices from other thought collectives protesting what has not been taken into account by so-called rational progress"(2018:100). This issue is of particular concern in agriculture where farmers who raise concerns about new technologies have largely been silenced, to only be proven right after the damage has already been done. This has been seen in southern Ontario where some farmers have been extremely active in making their voices heard regarding issues of ecological concern. Although their advocacy and oral testimony has been successful in creating positive change through the phasing out of neonicotinoid pesticides and in delaying the release of genetically modified alfalfa, the unwillingness of researchers and

governments to listen to their concerns has delayed reaction resulting in detrimental effects to ecology. There has been a collapse of bee colonies as the result of neonocotiniod use and although Ontario was successful in at least delaying the release of GM alfalfa, it is currently being grown in the United States. This is despite concerns raised by many farmers about issues of cross-contamination with organic and wild varieties, and problems with persistence in the environment. Farmers have repeatedly pointed out that alfalfa is a perennial crop, making it distinctive from other GMOs as they are self-propagating and therefore impossible to control.

Eben Kirskey, Craig Schuetze and Stefan Helmreich advocate fully embracing the work of "other sorts of experts" as a way of "destabilizing power hierarchies based on expertise" (2011:10). This "politics of destabilization" is integral to my research. This does not mean that all knowledge is inherently of equal value, but that there is much to be learned by incorporating science that is often dismissed due to the informality of its attainment and structure. During the processes of thinking about my research I struggled with reconciling how to approach diverse knowledges. I wanted to acknowledge the differences between agrarian science and more formal science (such as that which takes place in the academy), while attempting to dismantle the hierarchy that privileges one way of knowing over another. But as I attempted to differentiate between different knowledges I found myself assigning value to them. In my notes I referred to positivist science as "reductionist" and "simple", while categorizing agrarian science as "holistic" or "complex". Gieryn (1995) suggests that "attempts to distinguish between 'good' and 'bad' science are examples of boundary work, or how scientists and institutions patrol and defend the realms of what counts as science" (cited in Campbell 2011:48). In my attempts to elevate the importance of agrarian science I was guilty of reinforcing the same ethic I was trying to unsettle by establishing a hierarchy of which knowledges I found most valuable. This is tricky terrain. In reality, the boundaries of science are more blurry than one might suppose and so what may be described as "good" or "bad" science cannot easily be determined simply by the methods used or the declarations of expertise by the researcher. Similarly, the boundaries between agrarian science and what is often

described as global science are fuzzy as all of the agrarian scientists I encountered have benefitted from an education that relies on positivist science and many researchers acquire their expertise through interactions with non-specialists.

The knowledge politics that manipulate the use of scientific claims for political ends (including those leveraged by environmental movements) must be approached critically and with careful consideration of their impacts (Turner 2011:303). Science is never neutral in its application, despite the claims of some, and farmers leverage scientific claims-making in all sorts of interesting ways: to shore up their identities as "good" or successful farmers; to situate themselves in opposition to the status quo; to take advantage of narratives of "environmental sustainability" and "carbon sequestration" as marketing strategies. It is tempting to just accept the positives that have resulted from farmer engagement with the politics of science by focusing on the realized and potential benefits of agrarian science in creating more sustainable ecologies. However, this view is too simplistic. Although many of the farmers I encountered appear to feel very strongly about the importance of change and want to enhance the health of our planet's ecology, part of the impetus for change is that it is beneficial to themselves and their position as farmers.

Farmers leverage scientific claims-making to disrupt a global food system that increasingly marginalizes those who fall outside of the dominant paradigm. Farm organizations play an important role in bringing like-minded farmers together to advance particular political aims and the efforts of individual farmers within these organizations illustrate the strong desire for change within southern Ontario agriculture.

5. Community Leaders—Leading the Charge

Never doubt that a small group of thoughtful, committed citizens can change the world; indeed, it is the only thing that ever has.—Margaret Mead

When exploring agrarian reform it is important to consider the role of farmers' organizations which have been instrumental in the enactment and shaping of policy and are an essential aspect of creating change in agriculture. Farmers' organizations have a

long history in Canada, yet their influence is often ignored or minimized in the rush to condemn the current state of agricultural policy. Historically, these organizations provided a forum for farmers to collectively advocate for policy that would enhance their social and economic well-being. Membership has since evolved into a necessity as farm organizations often facilitate the delivery of many government programs and membership numbers are a necessary component of application. Two national organizations, the Canadian Federation of Agriculture, and the National Farmers Union (NFU) (aligned with La Via Campesina and the global movement for food sovereignty), have emerged as significant forces in shaping agricultural policy over the past century. These national organizations have close affiliations with their provincial counterparts, which in Ontario are the Ontario Federation of Agriculture (OFA) and the National Farmers Union of Ontario (NFU-O).

All of the farmers I spoke with were members of either the OFA or NFU-O. Farmers were divided almost exclusively based on their methods of production, with conventional farmers belonging to the OFA and organic, ecological, or biodynamic farmers belonging to the NFU-O. This makes sense in terms of politics as the OFA has historically taken positions that reinforce conventional models of agriculture focusing on the benefits of biotechnology, while promoting the importance of sustainable intensification and access to markets. Their website promotes a vision of agriculture as a "science-based and technologically savvy industry" and a commitment to enabling farmers to "enjoy continual productivity enhancement" (OFA 2019). Their website also claims a commitment to addressing the complex challenges surrounding sustainability and climate change, however their interests clearly also emphasize the importance of farmers' livelihoods as they declare: "we believe that no provincial or federal climate change policies should have the effect of negatively impacting the ability of farmers in Ontario to compete in domestic or international markets" (OFA 2019).

In contrast, the NFU-O brands itself as "the farm organization for family farmers" promoting a vision of agriculture that includes: "promoting environmentally-safe farming practices; giving farm women an equal voice in shaping policy; involving, educating and

empowering rural youth for a better future; and building healthy, vibrant rural communities" (NFU-O 2019). Their website also promotes the importance of agroecology, addressing climate change, the need for seed saving, and the importance of building an alternative food system based on food sovereignty (NFU-O 2019). This is a very different vision for agriculture than that promoted by the OFA.

Although all of the farmers I spoke with belonged to one of these two farm organizations, the reality of agricultural affiliations in Canada is more complex. There are a number of other communities of practice representing the interests of various collectivities with disparate interests and most farmers are affiliated with more than one organization. A number of these affiliations are based on specific commodity production (poultry, dairy, grain, eggs) or a specific market orientation, and there are also several organizations to address the needs of organic or ecological farmers. As Grace Skogstad states: "Structural changes have divided farmers in their interests and organizational representation, even while their numbers dwindle. Across farmers, schisms have become more acute between export-oriented producers and their inward looking counterparts, with the former less willing to support protectionist strategies at home" (2008:497). The fragmentation of the farm lobby has important implications. The first is to illustrate the vast differences between farmers in Ontario and to acknowledge that in light of the diversity and complexity of the industry, there will be a number of competing agendas and interests even within a single organization. The next is to consider how this fragmentation creates both barriers and opportunities for farmers as they attempt to create change.

While it is evident that the farm lobby is both complex and contradictory, the way agricultural policy is created and enacted allows for some maneuverability for farmers. Historically, farm organizations have had a substantial influence over policy as agriculture was seen as an "exceptional" part of the economic sector (Skogtad 2007). While global economic forces may be challenging the status of small and medium-scale farmers, the ability of the farm lobby to influence how agricultural policy evolves and is implemented can still be seen in the continuation of stabilization policies, the ability of

farm organizations to disrupt policy initiatives such as the release of certain forms of biotechnology, and the development of services and programs that support small-scale and organic farmers. This is especially notable in cases of programs for ecological and organic farmers as they are such a marginal segment of the agricultural sector. Farm organizations provide the opportunity for farmers with common goals to create strategic alliances that further their interests. As I have illustrated throughout this dissertation, these organizations also create connections through which farmers share important information about what is occurring within their farming systems, as well as what strategies and processes they are experimenting with.

Throughout my research, farm organizations were a consistent presence. Many of my interviews and informal conversations were a direct result of my having engaged with farmers at events sponsored by farm organizations. As I spent time among farmers at the conferences of both the OFA and the NFU-O, and as I attended field-days and union local meetings, I began to appreciate the individual contributions that members make to these organizations. The success of these organizations relies on the efforts and actions of individual farmers who organize events and energize others to do their part to create change. These community leaders are integral to farming and to providing hope for the future. Let's meet a few of them now.

5.1. Emily

Emily was one of my very first contacts in the farming community and without her, my research would be missing something crucial. After a phone interview with the then-president of the NFU-O, I had reached out to a number of union locals attempting to gain access to meetings where I hoped I could learn more about the farming community. Emily responded to my enquiries and expressed interest in hearing about my research. She said she was planning on attending a union local meeting in a neighbouring county the following weekend and asked me if I wanted to attend. I enthusiastically accepted her invitation and offered to carpool, suggesting I would be happy to do the driving. She agreed, revealing that she didn't really like long drives. Although I was a little surprised

that she agreed to my proposal since we had never met, I was excited that I would get a couple of hours to speak with her in the car and that I would not have to arrive at the meeting alone.

It was a Saturday morning, and the weather was overcast and damp. Emily arrived and after quick introductions we hopped in my car and began our journey. I noted that Emily was a few years older than me, perhaps late forties and she had short brown hair and wore glasses. She had a welcoming smile and her casual demeanour quickly put me at ease. It was approximately a one and a half hour drive and I had planned to take the 401 (the province's largest highway), which runs in an east-west direction through southern Ontario. I had my Google map and directions printed, but Emily assured me that she had been to this particular farm before and knew a more scenic drive. Emily was amiable and warm, and as I drove the unfamiliar county roads she sparked conversation by asking about my research project. I gave her the same well-rehearsed answer I gave everyone who asked about my research—that I was interested in the unique ecological knowledge that farmers have due to their interactions within their farming systems and how this shapes the decisions they make. She admitted that she had spoken to a number of academics and researchers and some had been out to her farm. I took the opportunity to ask her about her experiences farming and was surprised to learn that she had not grown up on a farm. She said that she had grown up in a mid-sized city west of Toronto. When I asked her how she had gotten into farming, she told me she had married a farmer. She described how she had originally worked in the insurance industry, but after living on the farm and helping out, she realized she loved the work and the animals so much she decided she wanted to do it full time. She spoke with great affection and joy about getting up in the morning to do barn chores and told me about her favourite sow. She described this pig as an "amazing mother" and her fondness for the animal reminded me of the way I often speak about my dogs.

Emily also talked to me about her daughter and her daughter's involvement in 4H, which is an organization for rural youth. She spoke with pride about her daughter winning awards for showing her cattle, including at the Royal Winter Fair. As we chatted

over inevitable parenting struggles, Emily described the unique experience of raising children on a farm. She laughingly shared an anecdote about when her daughter was 11 years old and had asked to be present in the barn for a calving. Her daughter ended up in the barn in the middle of the night and shared with her classmates the next morning, between inevitable yawns, the fact that she had helped a cow give birth the night before. Emily chuckled when she told me that she likely left out the fact that she had ended up covered in placenta.

As Emily and I chatted, I was particularly struck by how passionate she was about the issues facing farmers in southern Ontario. We discussed a number of issues, including concerns about sustainability and government policy that she believed favoured the interests of corporations over family farmers. Emily revealed that her concerns had led her to take action and get involved in the farmers union. Through her activism she had made connections in the academic community and was passionate about shaping policy and trying to create change in the food system.

Throughout my research I frequently encountered Emily. I would see her at agricultural conferences such as those held by the NFU-O, the Guelph Organic Conference, and the Ecological Farmers of Ontario. We were invited to the same events, such as an artisanal dinner put on by the culinary institute at Fanshawe College in London, and Western University's Symposium on Sustainable Agricultural Systems in the Great Lakes Basin. Each time we would meet, we would chat about family and interests of mutual concern. Although I never had a formal interview with Emily, both she and her husband provided crucial information and insights into issues affecting the farming community. Their farm was one of two that I took my son to visit. My son still talks about his explorations of the cow barn and his fascination with finding an egg that had been laid among the hay bales by an errant chicken.

On a cold and snowy afternoon, Emily and I met for lunch at a local Thai restaurant. We had not connected in several months. As we sipped hot tea we had a very frank conversation regarding her concerns about farming. Emily expressed some

frustration that despite the activism of many in the farming community, including academic allies, and the voices of concerned consumers, that things did not seem to be changing much. She appeared a bit disillusioned and mentioned she was stepping down as leader of a major farm organization because she just had too many responsibilities. I knew that she had been asked to volunteer for the newly established Food Policy Council for London-Middlesex and I asked her if she intended to serve. She indicated at that time that she thought it unlikely. I found this extremely unfortunate as Emily had developed important connections throughout the farming community. She is insightful and listens to the concerns of others, and is an exceptional communicator. At the same time, I saw her decision to step back as completely understandable. As we chatted, Emily revealed that she felt too much responsibility was being placed on individual farmers to create change in our food system. I empathized with her point of view as she described how during discussions of climate change mitigation and environmental stewardship, farmers are often lumped together despite substantial differences in approaches to farming. She expressed that she was just trying to create a good life for her family and herself, just like everyone else.

Ultimately, Emily had become a kind of champion for the "family farmer" and for alternative approaches to agriculture. She was a force for change that many farmers knew and recognized as they interacted with one another at various agricultural events. Her efforts through involvement with the NFU-O were well-known. My impression through our conversation was that Emily felt a bit alone in her efforts and struggles. Although she is certainly not the only farmer who is a community leader, the demands of farm labour mean there are not enough volunteers, and even fewer leading the charge to create lasting change in our food system. Volunteering is time consuming and exhausting work. It requires considerable commitment. When organizations struggle to attract and retain volunteers, (which is an ongoing concern as volunteer retention is an issue that affects many organizations; see Garner and Garner 2011), those who are most committed to seeing change often take on the burden of more work than they can reasonably bear because they believe in the cause. From my experiences with southern Ontario farmers,

those who take the time to become engaged in politics are often highly invested in bringing about change. These are farmers who also have the responsibilities of farm labour, which, from my experience as a volunteer, is very hard work. They are farmers with partners, children, and sometimes aging parents, that also require their attention. Their willingness to advocate for change in the food system despite their other commitments sets them apart from others in the community.

Farmers who are personally and politically motivated to get involved often struggle with ideas of responsibility. While juggling multiple and sometimes competing priorities these farmers felt some sense of responsibility to *do* something. Their individual efforts were extremely diverse, but inevitably were driven by a strong belief that our current food system is untenable and that we need for things to change. Emily is one of those farmers. Throughout my research, Emily was a source of great personal support and she provided numerous opportunities for me to connect with other farmers. On that overcast and damp Saturday morning when we first met, she brought me to my first union local meeting. It was there that I met Liam.

5.2. Liam

Emily and I were the first to arrive at the union local meeting on that dreary Saturday morning. Liam greeted us at the door and appeared a bit distracted. It seemed as though he wasn't quite ready to receive guests, although we had arrived shortly before the meeting was supposed to start. Within a few minutes, several farmers began to arrive and the downstairs area where we were meeting was soon filled. People began chatting in small groups and then the meeting was more formalized by a call for attention. Those who were scheduled to speak about issues of concern to the union took their turns addressing the group. During that particular visit I was introduced to Liam and we spoke very briefly about my research. He suggested I contact him at a later date and he would be happy to do an interview. That's exactly what I did.

It was several months later when I made my way back to Liam's farm. As I got out of my car, Liam walked toward me, one hand deep in his pocket while the other

struggled to keep the hair out of his eyes. A man who appeared to be in his early seventies, his hair was stark white, unkempt and wild, standing up in all directions. He plodded along, unhurried, his shoulders hunched as if burdened by a weight that I could not see. He shouted a greeting and raised his hand, acknowledging my presence. As he drew closer I could see that he had eyes the colour of glaciers, an improbable blue that automatically drew me in. I had the impression that these were eyes that had seen things, that had lived, and I found myself drawn to them in a way that was unsettling in its intimacy.

I began moving toward him and could see that he was wearing baggy jeans of a light coloured denim that had fallen out of style years past. They were hanging off of his wiry frame, and he hitched at the waist as he walked toward me. His shirt appeared to be blue, but as he got closer I could see the intricacies of a small blue and green checkered pattern and that the corner of the chest pocket was slightly torn. The first three buttons were undone, revealing a sunburned triangle of chest populated with a few white hairs. The bottoms of his pants were starting to fray and his work boots were so worn and dirty that it was impossible to imagine what they might have looked like when they were new.

Like other farmers I had met, Liam had the appearance of someone who spent a lot of time outdoors. His face was heavily lined, with a deeply furrowed forehead and creases at the corner of his eyes that spoke to a life spent squinting in the sun. He was similar to other farmers I had met who never seemed to wear sunglasses. His complexion was ruddy from many hours spent outdoors and he had the “farmer’s tan” characterized by sunburned face, neck and forearms. His hands were large, with long slender fingers as might befit a pianist, although the calluses and discolouration pointed to a long life of manual labour. Although he was over seventy years old and the decades of manual labour could be seen in the hunch of his shoulders and the character etched in his face, Liam had the energy and humour of a man half his age. He described how he had built his home himself and walked me around the outside of it pointing out certain unique aspects of its construction.

When he spoke, I detected the cadence and rhythms of northern Europe and after polite inquiry he confirmed he and his wife had come from Switzerland. As we spoke, he listened intently to what I was saying, absentmindedly rubbing his hand over his lips and chin and intermittently brushing his hair away from his eyes. Our conversation was punctuated by brief silences as he thought carefully about what it was he wanted to say. He spoke with purpose, not impulse, and told me about his life growing up on a farm in Switzerland and his decision to immigrate to Canada and become a farmer here in southern Ontario—a decision which was driven largely by the promise of affordable land.

Liam gave me a brief tour of his fields and barns before we made our way into the kitchen where we sat down at the table. As Liam washed up, his wife, who was soft-spoken, told me about their grandchildren and offered me some homemade lemonade. As I sipped the tart drink, Liam described a bit about his politics and his experiences transitioning from conventional to organic agriculture. I asked him about being a part of the NFU-O. He explained that he was the local union representative, and that he had gotten involved because he had seen a lot of things that concerned him and he believed the NFU had the right vision on how to create a better future for farmers in Ontario. Liam expressed strong beliefs regarding the importance of family farming and described the union as a force for helping to pressure the government for more supportive policy measures. He said:

> The government sometimes makes rules that are not really supporting small farmers. I think if you want an economy that is working, you need a lot of small armers. They work better than those big ones. Then you come into the money situation and the super rich. We laughed when Communism collapsed, but you look at things today and capitalism collapsed—it doesn't work. It shows it does not work on its own. You have to somehow regulate it that the rich have to pay more tax. Keep prices for farm products really low and the rich get richer and richer. If we don't do anything different there will only be a handful of people with all of the money. That's why it doesn't work. Everyone has to have some money to make the economy work.

As I discussed with Liam his efforts to create change by getting involved in union politics, he explained that he was actually hoping to step down from the role. Although he

still believed in the importance of being a union leader, he said that he was tired of the extra work. He revealed that he had asked for other members of the local to consider taking over his position so that he could focus on other things, but that no one had been willing so that he was "stuck" in the role for another year. I asked him if he was involved in any other efforts to create change within the food system and he said:

> Over the past 3–4 years with the neighbour together we offer farm tours so the people can come and see how the things are grown and see the cows, etc. It's really good. How can you teach those little children in school? I think our educator in Norfolk visits a hundred classrooms a year, where she teaches kids what farmers do. But that is conventional-minded and conventional driven.

I asked him why he felt this was so important and he said that it was vital to expose the public to farming so that they understand where their food comes from. As a farmer who had transitioned from conventional to organic, he also believed it was important for people to understand the difference between farming methods so that they can make more informed choices when making food purchasing decisions. For Liam, in order to create meaningful change in the farming system, farmers need to take responsibility for living their politics as best they can, including educating those who may not understand their position. This inspired him to become involved in his local union and to open the doors of his farm to school children and local families so they can better understand the unique aspects of growing food in Ontario. In this way, he hoped to create allies who would provide support, both through social pressure and through purchasing power, to help make a more sustainable future for family farmers in Ontario.

Like Emily, Liam was committed to a particular form of activism stemming from his beliefs that we need a different food system. Liam expressed serious concerns about the sustainability of conventional agriculture and advocated for a local food system to help decrease carbon emissions. He talked about the interconnections between things, suggesting if the land is healthy the animals will be healthy, and since the land and animals feed us, we in turn will also be healthier.

Like Emily, Liam also felt the stress and burden of being politically active while balancing his other responsibilities. His inability to step down from his role as local union representative was a bit of a sore spot, because he had felt he had given a great deal to the community in recent years and was ready to pass the torch. My belief is that when volunteers reach a level of fatigue where they need to step back, and there is no one willing or able to take over, they feel disheartened and somewhat alone in their willingness and commitment to create meaningful change. This sometimes created a sense of futility.

5.3. Edward

I began this dissertation talking about Edward and it is to him that I now return. I met Edward quite late in my fieldwork. He welcomed me to his farm on a sunny but cool November morning. As I took off my hiking boots so as not to dirty their kitchen floor, his wife admonished him not to talk my head off as she left to go take care of some errands in town. He chuckled with obvious affection and told her he would see her when she got back. I sat down at the table and Edward sat across from me, his elbows propped on the table. He leaned towards me and said: “Well? What do you want to know?” I laughed and fired back: “Well what would you like to tell me?” Edward laughed and began a long and surprisingly personal story of his journey to become a farmer. He described coming from a small island off of the south coast of England, of his extreme love of animals, and of working on his uncle’s farm. During his descriptions of childhood, Edward discussed his education and how he became involved in farming. He was open and vulnerable about very personal things that shaped his choice of livelihood. I’ve struggled whether to include his disclosures in my ethnography. Including them would bring depth to my descriptions of Edward and make for a richer ethnography. However, I can’t bring myself to include the parts of his story that seemed so deeply personal. I have no idea if Edward is so open and vulnerable with everyone he meets, but I felt that he and I connected during those few hours across his kitchen table and while walking around his farm. I think he felt similarly as we embraced briefly before I left.

Edward had similar feelings to many of the farmers I spoke with during the course of my research. He had specific concerns about government, the role of big business, and the inadequacies of academic research. Edward was particularly concerned about climate change and the failures of a food system that he believes has set us up for vulnerability instead of resilience. Speaking about these issues Edward described how he tries to do "his part" even though he struggles to hold out hope for positive change. He said:

> We're growing all the corn in North America from very little diversity. That brings problems, but you don't hear about those problems. That's what's scary. In the last number of years, I've seen [pause] everything has gone secretive. Big business, government. But we need to know what's going on so that we can set ourselves up. But everyone just seems to jump onto the bandwagon. That's why I say, I don't hold much hope that we're going to do very much. But I think. I do my bit. I save the seeds I can. We want more seeds that are drought resistant. In many countries around the world they grow a lot of different stuff in the same field. They grow three varieties of corn—one which is resistant to drought, one which is resistant to cold, or one whatever they feel. And they will take a percentage of the yield. While here it has to be yield, yield, yield, go for that one. You know everyone is going to grow the same darn thing, you know? And if that's not resistant to drought—whoops! Instead, you've go to share it around a little bit. But we're not. We're not even doing that.

As we talked, I asked Edward about his involvement in farm organizations and whether he felt they offered an avenue for creating change. He revealed that he was one of the founding members of the Ecological Farmers of Ontario, a farm organization that is committed to increasing biodiversity, mitigating against climate change, and supporting knowledge sharing (EFAO 2019). He said:

> I was one of the instigators of the EFAO with Tony. The two of us kind of started [pause]. How that all started was, for me, I wanted to go organic, although organic wasn't a term back then. It was after the Vietnam War. [pause] We met up with this bunch, I can't think of their names at the moment. (Name omitted) was one of the old guys who was the EFAO main guy. They'd come from Switzerland and Germany—a bunch of them. They were into biodynamics and so we had a few meetings on biodynamics and stuff so that's kind of [pause], and we got more and more involved and that was how EFAO got started. It was more just finding out knowledge, right? So we took biodynamic stuff and their theories and their way of doing things and kind of added that to what we knew about manure and legumes to put nitrogen in the soil and learned as we went. So that's what started the

> Ecological Farmers Association. It started very, very small. It started with a pretty tight bunch and so that's how we got the knowledge and now can pass it on, which we didn't have when we got started.

Edward said he did believe farm organizations offer some hope for change, but that the efforts of a relatively small group of farmers often seem futile against the machinations of corporate agriculture.

Edward's contributions to the development of EFAO are more notable than he likely realizes. The Ecological Farmers of Ontario are an important facilitator for knowledge transfer in southern Ontario agriculture. They promote and sponsor several events throughout the year to bring farmers together to share their knowledge and experiences. In 2016 they began a farmer-led research program. Early in my research I met with the then-president of the EFAO and discussed their philosophy and their programs. I was also fortunate to attend many EFAO sponsored field-days during the course of my fieldwork where I witnessed farmer-to-farmer knowledge transfer in action. It was the efforts of Edward and a few like-minded farmers who were dissatisfied with the status-quo that led to the development of this organization. Their efforts have withstood several decades of change in Ontario agriculture and offer new hope as farmers seek ways of coping with the unique challenges associated with climate change. Their influence may continue to grow as demographics change among farmers in southern Ontario. Recent research suggests that the demographics of farmers are shifting to include more women, as well as farmers who are new to agriculture, and that this change in demographics is correlated with changes in production methods as women farmers in particular are more likely to engage in ecological farming (Laforge et al. 2018). This study also pointed out that new farmers, as well as experienced farmers that are transitioning to become more sustainable, benefit from access to farmers who have the knowledge necessary for them to become successful (Laforge et al. 2018). Organizations like the Ecological Farmers of Ontario may therefore continue to provide important access to farmer knowledge exchange, the demand for which is likely going to increase.

Edward spoke passionately about climate change and the importance of changing the way we grow food. Like Emily and Liam, he was active in trying to create meaningful change in the farming community, yet questioned whether his efforts have any meaning in a food system that is increasingly dominated by the imperatives of capitalism. Although I personally believe their efforts, and those of farmers like them, are inspiring positive change in southern Ontario—whether it will be enough to create resiliency in the face of climate change remains to be seen.

5.4. Identity Economies and Hope for the Future?

As was revealed in the previous section and throughout this research, farm organizations have an important role to play in facilitating farmer-to-farmer knowledge transfer. They also provide the opportunity for like-minded farmers to connect and organize, and are an essential component to creating meaningful change in our food system. As was discussed in Chapter 2, Harriet Friedmann and Philip McMichael diverge in their characterizations of the current "corporate food regime". McMichael remains hopeful of the potential for grassroots movements to create positive change in the food system on a global scale. He describes these processes: "It is about a historically specific mobilization, in the name of 'food sovereignty,' informing an alternative world vision at a time when neoliberal capitalist institutions and policies are destabilizing whole societies and ecosystems" (McMichael 2016:649). Harriett Friedmann (2016) discusses the possibility of successfully moving away from our current system of ecological relations under a corporate-environmental food regime from a less optimistic perspective. She suggests that to disrupt our current trajectory will require multiple approaches driven by those who wish to embrace conservation, and that their efforts will need to survive without being absorbed by the dominant system (Friedmann 2016).

Julie Guthman (2014), in her book *Agrarian Dreams: the Paradox of Organic Farming in California,* takes a similar perspective to Friedmann by illustrating the limited ability of organic agriculture to transform the farming sector in California. Exploring the role of "organic" in the context of a "corporate food regime" is useful.

Organic agriculture is constantly in the process of reinvention and is often positioned as the antithesis of conventional agriculture. However, the ability of the organic movement to create change in agriculture has been limited by the constraints of a global food system intent on profits at the expense of the environment. Colloquially, “organic” is often used as a catchall to describe any method of growing food that does not rely on chemical pesticides and fertilizers. There are a number of farmers who capitalize on this distinction in order to gain consumer acceptance while demanding higher prices for their products. They market their products as “organically grown” even if they choose not to pursue certification. To be “certified organic” means compliance with the government of Canada’s organic certification protocols which include: the payment of certain fees, submission to inspection, and the completion of substantial paperwork. For some farmers, certification is worth the price of admission, especially in cases where farmers wish to access export markets or sell their products in grocery stores. Many of these farmers pursue organic because the price premium is a good business strategy. For others, “organic” is used to symbolize an alternative to the corporatization of agriculture. It represents a different philosophy, promoting ideals of small-scale agriculture and the family farm. This characterization of organic is slowly changing as “big ag” capitalizes on the higher prices of organic production.

Although organic agriculture was once symbolic of an alternative to corporate agriculture, it too is being subsumed by the imperatives of capitalism. You can see the effects of this in any grocery store where increasingly consumers can buy products, such as Dole bananas, that are certified organic, but that are being produced by large corporations. As a result, some farmers in southern Ontario are beginning to abandon organic certification. I spoke with a number of farmers who had decided that they were no longer going to fulfill the requirements necessary for certification. These farmers have not changed their production methods, but have eschewed taking part in government certification to reinforce their distinction from corporate agriculture. If "big ag” is certifying organic, they have chosen to no longer take part in certification. Julie Guthman had similar findings among farmers in California. She states: “It is striking that after all

the efforts to define and defend 'organic' some in the movement have already abandoned, or are about to abandon the name 'organic' for its failure on both social and ecological fronts" (2014:171). These practices may represent farmers attempting to live their politics, but they are also strategic in the current social and political climate where it can be advantageous to set yourself apart from competitors who are not doing enough to create a distinction between themselves and corporate agriculture. Julie Guthman similarly revealed that farmers see "these initiatives as overt attempts to recover some of the organic movement from the organic industry" (2014:171). Farmers who have done this successfully have established close and trusting relationships with their customers that enable them to continue to demand higher prices even without certification. These efforts represent the work of farmers struggling to push back against the dominant system (a system they must also partially embrace in order to make a living) without being consumed by it.

As my research has shown, farmers face economic precarity and sometimes must make trade-offs in order to survive. Like Lukas, the organic pig farmer who expressed a strong commitment to ecological principles but who accesses lucrative export markets in order to ensure the viability of his farm business, even farmers who are very committed to sustainable agriculture risk being subsumed by the realities of capitalism. As Friedmann states, "stickiness permeates regimes, limiting alternatives for emergence" (2016:255). Farmers in southern Ontario are in the precarious position of navigating between conflicting priorities while struggling to survive in a food system increasingly controlled by the imperatives of capitalism.

As is illustrated throughout this dissertation, there are a number of farmers actively working to subvert the mechanisms of industrial agriculture. Whether these farmers just employ ecological methods within their own farming systems, or are actively engaged politically, each of them is contributing to an unsettling of the dominant system. However, even when there is motivation to create change, farmers are constrained by complex social, political, economic and ecological factors that may limit their ability to create lasting transformation. This can create frustrations for farmers who are constantly

in the processes of negotiating and remaking their identities as they struggle to live their politics while facing the realities of economic precarity.

In trying to anticipate whether or not grassroots movements have the potential to substantially change our food system, the concept of "identity economy" is good to think with. The concept of an identity economy comes out of recent work in economics. George Akerlof and Rachel Kranton (2011) attempt to explain why people facing similar economic conditions make different choices. Their theory is that people's conceptualizations of who they are, and who they want to be, rather than just economic incentives, shape their decision-making. In one respect, this idea appears to offer hope for meaningful change by challenging the notion that farmers make decisions solely based on economics. My research also reinforces this idea, which was illustrated through farmers' cultivation and maintenance of a "good farmer" identity. However, what this analysis fails to take into account is the realities that individuals may attempt to make choices based on their understandings of who they are and what type of world they want to create, but this is sometimes very difficult based on externalities. In order to resolve the uncomfortable feelings this causes, individuals will find ways to justify their decision-making even when it conflicts with their politics. As Lukas, the organic pig farmer who ships to China stated:

> I'm not against importing and exporting, because if you only have local food the farmers can charge whatever they want. Without the pressure, the local farmers can charge whatever they want. But local food is important, Especially if there is a disruption in world supply. In a time of crisis, you can't live without local food.

Some of the contradictions are apparent in his statement. Lukas must declare that he is not against importing and exporting as he exports his own production. Yet, he attempts to emphasize the importance of a local food system as well. Politically, these positions are at odds and this example provides a nice illustration of the limitations individuals face when attempting to live their politics in an economic system that requires them to make trade-offs or risk the viability of their businesses.

Thinking in terms of an "identity economy" helps to illustrate the complexities of farmer decision-making. Whenever possible, farmers attempt to make decisions not solely based on economics, but on their values and sense of who they are. I do believe this provides some measure of hope for change. As has been illustrated throughout this dissertation, there are many individuals and farm organizations attempting to transform our food system. The National Farmers Union is affiliated with La Via Campesina and the Global Movement for Food Sovereignty, illustrating a solid commitment to creating a sustainable food system based on small-scale family farms. However, it is important to note that these farmers are in the minority and not all farmers have the same values, or have the same vision for the future. For some farmers, economic concerns are paramount and this reflects their particular value system. The implications of a commitment to capitalist logic are not their concern and they are unlikely to make decisions in pursuit of the "greater good" if this requires them to make substantial changes to their farming systems.

Efforts by farmers to disrupt the dominant paradigm are noble, but they are often also pragmatic. Many small and medium scale farmers are struggling financially and leveraging narratives of alternative agriculture, including those surrounding "climate-smart" or "sustainable" farming, offer possibilities for capitalizing on markets provided by ecologically-conscious consumers. As such, it remains to be seen whether farmers will be successful in creating meaningful change, or if they will become overwhelmed by the dominant system. However, as climate change creates new pressures for farmers, those who have already embraced an ecological approach to agriculture may have some unique advantages. Industrial agriculture is particularly vulnerable to climate change as it relies on very little genetic diversity. In its attempts to gain efficiency, industrial agriculture has perhaps not adequately prepared itself for the unique challenges that farmers will face as a result of rapid changes within ecology. As has already been seen with the evolution of glyphosate resistant "superweeds," relationships within ecology are emergent and entangled, with unpredictable results. In this context, having a food system that relies on a few key crops designed for intensive production, appears extremely short-sighted.

Although corporations are busy attempting to create resilience through genetic modification, adaptive capacity and resilience in agriculture are more likely to be found through plant breeding and increasing agrobiodiversity. The demands of this require the labour of many agrarian scientists who can do much of what they have always done—experiment with plant breeding, share knowledge with others, and adapt to the constantly changing pressures that shape what it means to be a farmer.

6. Discussion

Climate change is the defining issue of our time. Relationships within ecology are undergoing such radical and rapid transformation that it is seriously inhibiting the ability of many species to survive. If we do not take steps to address this, humanity may face its own extinction. Agriculture is implicated in these processes through the creation of greenhouse gas emissions and through the perpetuation of exploitive relationships within ecology that have directly led to biodiversity loss, soil and water pollution, and hazardous effects on living organisms (Tabur 2009; Van Der Oost et al. 2003). Although all forms of agriculture require processes of mediation between humans and the rest of ecology in order to facilitate the perpetuation of desired species at the expense of others, not all models of agriculture are equally exploitive. Industrial agriculture is unique in its adherence to specific techno-scientific forms of intervention that have fundamentally transformed the way we produce food and which threaten adaptive capacity and resilience to climate change through the reduction of biodiversity.

If we understand Earth as a complex system, the diverse relationships and exchanges that occur within this system reveal entangled and often contingent dependencies. Higher species diversity is linked to increased ecological resilience (Naeem et al. 1994). So when agribusiness displaces small farmers in favour of industrial monocultures, biodiversity suffers making the entire system vulnerable (Goodall et al. 2005 in Hiranandani 2010:765). The FAO (2016) estimates that of the approximately quarter of a million plant varieties available to be used in agriculture, less than three percent are in use today. These agrodiversity losses are in addition to the destruction of

forests, habitats, and other species as a result of the radical transformations within ecology necessary for the perpetuation of industrial monocultures. As such, the loss of biodiversity is one of the direst consequences of the industrial model of agriculture. With the pressures of a rapidly changing climate, the preservation of biodiversity must be a priority as genetic diversity offers a measure of adaptive capacity in the face of an uncertain future.

Farmers in southern Ontario have largely embraced an industrial model of agriculture that includes large-scale monoculture and the use of chemical pesticides and fertilizers, as well as intensive livestock operations. Although many of the farmers I spoke with recognized the limitations of this approach and some strongly advocated for changes within our food system, my research reveals that many feel trapped on the treadmill of investment in high-yield production technologies, and economic precarity makes change increasingly difficult. Compounding the problem is the lack of commitment by the Canadian government to create meaningful change towards a more sustainable agricultural sector. As Hiranandani reveals: "government support for sustainable agriculture in Canada has been marred due to lobbying by profit-motivated agribusiness interests and the perceived conflict between environmental and economic performance of agriculture" (2010:766) (see also Maynard and Nault 2005; Strang 2006). Despite claims by advocates of industrial agriculture that without chemical inputs farms would be less productive, studies show that utilizing sustainable cropping strategies actually increases yields by as much as 60 percent (Hiranandana 2010:765). "Sustainable agriculture has challenged the assumption of high productivity of industrial agriculture by proving to be more productive and ecologically sound" (Hiranandana 2010:765). As well, sustainable approaches to agriculture often employ polyculture strategies that provide a modicum of protection against massive crop failures. Farmers who rely on one or two key crops are vulnerable to catastrophic losses should a specific disease, pest, or weather event threaten their production. Sustainable approaches to agriculture often integrate multiple crops and livestock into the same system so that if something fails the outcome is not ruinous. "Crop diversification can improve resilience in a variety of ways: by

engendering a greater ability to suppress pest outbreaks and dampen pathogen transmission, which may worsen under future climate scenarios, as well as by buffering crop production from the effects of greater climate variability and extreme events" (Lin 2011:183).

Agriculture is one of the largest contributors to climate change, however farmers are also particularly vulnerable to climate change impacts that threaten the viability of their farm businesses. As Sapkota et al. reveal: the "dependency of people on natural capital poses a risk to livelihoods due to the uncertainties surrounding climate change" (2019:180). Although farmers in southern Ontario have yet to experience the dire predictions of scientists in terms of drastic changes to weather patterns or an increase in severity of adverse weather events such as floods and droughts, the farmers I engaged with throughout my research were aware of the potential challenges of climate change and many were taking steps to enhance their ability to adapt. The farmers I spoke with have witnessed the catastrophic losses experienced by other farmers, such as the record flooding that occurred in the American midwest this past March (CNN 2019) and are aware of the potential challenges they may face in the future. For some farmers, climate change has become a social and political reality that must be addressed now, as both domestic consumers and export markets make demands for sustainable production.

As farmers navigate uncertainty, many are seeking ways to enhance their knowledge through engaging in practical experimentation with different production and marketing strategies. Some farmers in southern Ontario are trying various methods, such as cover-cropping, experimenting with low or no-till farming (no disturbance of the soil), and with planting exotic varietals. Others are reviving processes of seed saving and experimenting with the planting of heirloom varieties, or are diversifying their economic strategies by opening their farms to surrounding communities through direct marketing, or by investing in sustainable energy technologies such as wind or solar. Each of these strategies reflect wider grassroots movements towards a more sustainable approach to agriculture. These approaches are diverse and, unlike industrial agriculture, attempt to encourage healthier relationships within ecology. Some of the processes used to increase

sustainability include: avoiding the use of chemical pesticides and fertilizers; utilizing technologies that enhance soil and water health; employing crop rotation, composting, and livestock manure; and the use of polyculture strategies. These approaches enhance the adaptive capacity of farmers while also reducing agricultures impact on ecology. In some cases, ecological approaches to agriculture can be regenerative, increasing soil health and helping to sequester carbon. A number of farmers also engaged in activism and politics in order to create positive change within the food system. Other strategies include taking part in counter-movements such as the organic, agrocecological, biodynamic, grow local, and slow food movements. Each of these strategies, to varying extents, attempt to mitigate some of the environmental concerns associated with industrial agriculture by advocating ecologically based agricultural production, the reduction of "food miles" by relocalizing food, and have an emphasis on universal access to healthy, sustainable food and on greater social and economic justice (Siniscalchi and Coumihan 2014).

Engagement with diverse approaches to sustainable agriculture are not just the domain of farmers who are committed to organic, ecological, or biodynamic methods. Farmers of disparate methodological orientations, including a number of conventional farmers who took part in this study, are accessing diverse knowledges through engaging in farmer-to-farmer exchange during field-days, or at events arranged by farm organizations. Although my research illustrated that some conventional farmers have begun integrating sustainable methods into their systems, my experiences also showed a reluctance on the part of conventional farmers to declare a commitment to alternative forms of agriculture. This may be in part due to the political and social pressures that have evolved around certain farming identities, and also the economic realities of being caught up in the conventional system. Farmers can't easily overhaul their entire production systems, so how conventional farmers approach narratives of sustainability and begin to integrate sustainable cropping strategies will be an important area for future research.

Some farmers also increase their knowledge base by interacting online and are inevitably shaped by their personal relationships, including the complex multi-species

relationships that evolve through their interactions within ecology. The unique nature of farm labour leads to multi-species entanglements that shape farmer decision-making in a multitude of ways, resulting in sometimes contradictory and unpredictable behaviour. Many farmers experience these relationships acutely and these entanglements have important implications for sustainability discourses. Each of these factors shape the ways in which farmers approach their farming systems and how they create their own version of what it means to be a "good farmer."

Farmers are increasingly called upon to navigate between growing food for domestic and global markets, while being sensitive to ecological concerns. Some farmers have embraced this responsibility, while others have expressed resentment at being thrust into the role of environmental stewards when they believe their responsibilities are to themselves and their families. Policy-makers are attempting to navigate these difficulties by developing programs that provide financial compensation for farmers who provide ecosystem services on their land. These programs, however well-intentioned, raise important concerns about what is driving farmers' willingness to create change for a more sustainable future. If economic concerns continue to be the primary force behind decision-making in the food system, our relationships with the rest of ecology will continue to be based on capitalist exploitation for maximized profit. If we are to create meaningful change, the narrative needs to shift so that there is recognition that the survival of humanity is contingent upon our repairing relationships within ecology. However, it is also important to acknowledge that farmers must remain economically viable if they are to survive, and these often conflicting obligations create unique issues for farmers. Examining how farmers approach their role as stewards and their willingness (or not) to take on the additional responsibilities of addressing ecological concerns provides important avenues for further research.

As farmers engage with the politics surrounding food production, they encounter scientific claims-making that sometimes differs strongly from their lived experience. The southern Ontario farmers I met were very vocal in their concerns regarding the manipulation and use of science as a tool for powerful corporations. Many expressed a

belief that the influence of corporations has corrupted government and educational institutions to the detriment of the public good. These narratives were especially salient in discussions surrounding ecology and the sustainability of agriculture, where farmers who have abandoned conventional models believe strongly in the ability of ecological principles to help address the current crisis. This aspect of my research requires further exploration. Harry Collins and Trevor Pinch (1999) suggest that attitudes towards science and technology tend to be divided among those who see the possibilities as inherently promising, and those who see science and its commercialization by powerful corporations as being detrimental to ecology. This does not mean that farmers who envision a more sustainable food system are anti-science or inherently suspicious of new technologies. Sustainable agriculture models rely on sophisticated soil science and complex understandings of chemistry and genetics. For the farmers with whom I work, technology is not inherently good or bad. However, prophylactic use of technology for technology's sake is often viewed as problematic without critical engagement.

Farmers in southern Ontario live in a society in which scientific claims have considerable authority and all of the farmers I worked with were educated in a system that privileges positivist science. My experiences with these farmers suggest that their willingness to take part in research, including my own, may in part be due to their recognition of the inherent value of scientific inquiry, while also strategically supporting researchers whose claims can be leveraged to support their own political aims. In the context of my research, farmers of diverse methodological orientations leveraged different scientific discourses to bolster their own ideological positions. Similarly, farmers would use competing science to discredit the positions of those who held distinctly different views. There is nothing particularly surprising about this. As a researcher, I do the same thing. However, as we address the complex issues surrounding climate change, the realities of competing scientific discourses requires us to think carefully about how we, as scientists, assert our authority. Humility and the realization that there are multiple truths and diverse ways of knowing requires us to admit that we may not always have all the answers. We need to remain aware of the potential conflicts

of interest that exist when policy-makers rely on science produced by corporations who are heavily invested in the outcomes. Thinking about these issues matters. Public engagement with discourses that rely on scientific claims-making shape understandings and perceptions. Trust in science matters. Collins and Pinch suggest "that rather than a saviour or vengeful monster, science is a golem" (in Smart and Smart 2017:68). "In Jewish mythology, a golem is a powerful creature made by spells that animate clay. Without careful control, it may destroy its masters with its unthinking strength" (Smart and Smart 2017:68). As Alan Smart and Josephine Smart reveal, "All tools, and the disciplines that create them, have the potential to do damage as well as useful work. The golem of science is not the problem; the failings arise from how we control its powers or how we fail to do so" (2017:68).

Throughout this dissertation I have alluded to the unique "techno-scientific" forms of intervention that characterize industrial agriculture. Technology is a broad term that includes a variety of tools and methods that often act as a mediator between different species. Anthropologists have long sought to understand how humans interact with different technologies. Ian Hodder (2012) believes we should examine what sorts of possibilities (which are both diverse and limited) that things and tools make possible. All of the farmers in my research accessed and utilized science and technologies to enhance their production. Organic, ecological, and biodynamic farmers engaged with cutting-edge soil science that has emerged out of diverse disciplines, as well as agrarian science, to help enhance the viability of their farming systems. Ecological farmers also utilized a diversity of technologies including: tractors and other farm implements; horses; "natural" pesticides; manure and compost for fertilizer; sophisticated plant breeding; and the strategic use or enhancement of other species to achieve a desired result (such as the use of lady bugs to control aphids). Similarly, industrial agriculture utilizes science in the development of specific technologies to enhance productivity. Some of these technologies include: biotechnology (the use of biological and genetic science to utilize or modify living organisms); Radio frequency identification (RFID) tags on cattle; tractors, combines and other farm equipment; drones and GPS controlled cultivators; as

well as the emergence of precision agriculture (which utilizes satellites to measure variability in crops) and nanotechnology (the use of miniature robots in nutrient and pest control).

Technology is a form of mediation within ecology. Technologies change labour, economy, and sociality (both enabling and disrupting connections) and influence politics through legislation, trade, lobbying, and opposition. When it comes to interrogating how we have reached a point in our history at which our survival as a species is at stake, we need to reflect on our use of various technologies and their impacts (often complex and sometimes unintended). As Markus Lipowicz suggests, "The emergence of new technologies gives us the opportunity to raise the most fundamental question of any pedagogical reflection: what defines a human being and how does the human become human?" (2017:10) I have tried to illustrate throughout my dissertation that our relationships within ecology are essential to what it means to be a farmer, and more broadly—what it means to be human. All species rely on other species to survive. We are not alone in this. Biodiversity as a biological and ecological concept confers adaptive capacity and resilience through genetic diversity (see Petersen et al 2018). In other words, the more diversity there is on the planet, the easier it is to survive. The fossil record provides evidence for smaller piecemeal extinctions prior to most mass extinctions, suggesting that biodiversity loss is a predictor of mass extinction (see Stanley 2016). In the face of a changing climate and feeding a burgeoning world population, the greater the diversity, the better our chances of survival.

Anthropologists have critically engaged with discourses surrounding transhumanism and posthumanism in recent decades. "The central tenet of transhumanism can be summarized as the belief in overcoming human limitations through reason and technology" (Smart and Smart 2017: 89). Industrial agriculture relies on an ethic of progress and of the potential for technology to overcome the limitations of ecology. Biotechnology and nanotechnology for example, can be seen as enabling a plant to move beyond its species capabilities. This reinforces an ideology that sees humans as fundamentally different from, or outside of, the rest of ecology. As we attempt to address

the complex issues associated with climate change we need to think carefully about this ethic. Within the context of climate change and agriculture, ecological farming technologies versus the technologies promoted by "big ag" require fundamentally different approaches. Ecological approaches, although not perfect, attempt to reduce the burden of agriculture and to repair (where possible) relationships within ecology to ensure greater survivability and quality of life for as many species as possible. Industrial approaches attempt to overcome any potential obstacles by whatever technological means are at our disposal. In the context of climate change, you can see this ethic in rhetorical discussions about the potentialities of colonizing other planets. In this case, technology can be viewed less as a potential answer to a complex problem and more as a means of deferral—delaying the consequences of our interactions within ecology until such time as they can no longer be avoided.

I had interesting conversations with farmers about these issues. My experiences with farmers in southern Ontario is that many do not subscribe to an ethic of bioconservatism (inherent skepticism towards technological advancement)—unlike some radical environmentalists. There was more of an ethos of responsible technologies rather than a view of technology as essentially positive or negative. There was an acknowledgement of the impacts of certain technologies in agriculture (both good and bad) that while providing benefits, may also undermine adaptive capacity and potential future productivity due to its short-sightedness. This is why acceptance of biotechnology has been mixed and why even those who have embraced Roundup-ready corn and soy opposed the introduction of GM alfalfa (a perennial plant). At the farm level, many growers understand the potential outcomes of introducing a genetically modified perennial plant that will cross-breed with wild populations. Decisions on what technology may be useful or appropriate rely on the consideration of multiple factors, not just potential yield, ease of use, and profitability factors. The inability to control the technology is where many farmers draw the line at what is acceptable and that which needs responsible regulation or prohibition.

As farmers contend with the diverse social, economic, political and ecological challenges associated with climate change, they will have to navigate emergent technologies and make decisions about which approaches best reflect their values and interests. Agrarian science has an important role to play in evaluating the impacts of technologies within agriculture and has the potential to produce more nuanced understandings of the diversity of potential outcomes that occur as the result of any technological intervention. As researchers, we too need to look beyond disciplinary boundaries and the limited context of what are often very brief research encounters, to think very critically about the interactions that occur in ecology. If we accept the fact that our survival as a species is reliant upon our relationships with the others with whom we share our ecology, we must attend carefully to how our interactions with other species shape our own capacity for survival. As Alan Smart and Josephine Smart remind us: "Humans fail to treat our non-human collaborators in the history or pre-history of *Homo sapiens* as anything other than passive resources. Post-humanists are left the task of bringing them back in and showing why it matters" (2017:69). As researchers, this requires us to think carefully about our own approach to research and how we are implicated in either reproducing or challenging existing discourses.

6.1. Reflections on Research

We are predisposed to think of scientific endeavours in terms of outcomes, in terms of production. The purpose of a doctoral program is supposed to be the contribution of new knowledge. Something I can claim, assert as my own, and then proffer on the altar of academia as proof of my worthiness as a researcher. If I hope to succeed in an academic career, the salience of my claims will ultimately be measured in terms of my ability to conform to what is considered valuable in the knowledge economy (visible through successful grant applications), and my productivity will be assessed in publications—how many, and in which journals.

I could write several paragraphs describing how my research contributes to a growing body of work on the importance of including agrarian science in our

understandings of ecology and adaptation to climate change[16]. I could claim that anthropological approaches to understanding climate change adaptation strategies in southern Ontario appear to be limited, and my perspective helps broaden our understandings in this particular context[17]. I could assert that taking a multi-species approach can help widen our gaze in the hopes of creating a more inclusive future for all species[18]. However, I do not feel comfortable making these claims. The outcomes of this research are not so much mine, as the culmination of the diverse understandings and knowledges of the many farmers who contributed to this project. Their knowledge is not mine to claim. I acknowledge that the analysis and connections are mine, however these too are the result of interactions with the productivity and knowledge of innumerable scholars of diverse disciplines. To claim the bulk of the productivity herein would be disingenuous. Through this process, I have been "cultivating knowledge" and the privilege is mine. It has truly been an experience of growth and learning.

Did I make a contribution to knowledge? I can claim it, but it's not for me to decide. Isabelle Stengers suggests that the "social sciences could both learn and valorise their knowledge in an environment where that knowledge would not be an authority, but

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16 The literature on citizen science, or "local" knowledge in helping to create greater understandings of ecological relationships and to address the hierarchies between different ways of knowing is extremely broad and my research attempts to expand on those discussions within the context of southern Ontario. I also build on recent work in discussions of ecology that attempt to engage with both the biological sciences and social sciences to provide more nuanced understandings of ecological processes. Within the context of my research it should be understood that each of these approaches is limited on its own, but the synthesis between different bodies of work and different ways of knowing offers important avenues for understanding the complex challenges surrounding climate change.

17 See Wall et al. 2007; also see Desjarlais and Throop 2011, Crate 2011 in the Annual Review of Anthropology October 2011 issue 40 although this is not specific to the Canadian context. My review of the literature revealed extensive contributions from the environmental sciences and economics, with some social science literature focused on mitigating risk and increasing resilience. There appears to be a lack of anthropological approaches to climate change specifically within the context of southern Ontario, however there is a broad scope of literature based on anthropological perspectives of these issues based on fieldwork in other geographical locations, which I have referred to throughout this dissertation. Much of the climate change research in Canada appears to focus on managing risk and increasing adaptive capacity. My research attempts to reinforce that climate change and agriculture are mutually reinforcing processes so that we need to be looking at not just strategies that reduce risks to farmers and their businesses, but addressing those processes of agriculture that contribute to climate change.

18 Similarly, perspectives which include an engagement with multi-species entanglements appear to be limited within the context of southern Ontario, however these approaches have been used extensively both in North America, and specifically within the contexts of agriculture (see Paxson 2013 and Wilkie 2010 for examples).

a resource" (2018:76). I like that distinction. That my contribution as a researcher is not an exercise of expertise or authority, but a resource to be accessed. Its value (if any) to be determined by the context of the inquiry.

What I wish to argue for is the inherent value of the research endeavour itself. Research and the quest for knowledge are worthwhile apart from any productivity that results from the encounter. I envision science as a form of communication between differentially situated species (humans and/or others). That communication is always partial and the intelligibility of the encounter is highly varied. But there is inherent value in the processes of trying to communicate, in learning from one another. There is significance in undertaking the effort and in attempting to establish relationships. That value does not diminish under the measurements of productivity.

Like many of the farmers with whom I did research, I am concerned about the influence of corporations on our academic institutions and the unwillingness of governments to invest in publicly-funded science. This may seem ironic in light of the fact I am a researcher who was funded by a government grant. However, I acknowledge that my success was due in part to the fact my project is particularly compelling in the current social and political context. I am acutely aware of the fact that many of my contemporaries, with applications just as well-written, and with projects just as valuable and well-researched, did not receive the same acknowledgement or funding.

The ways in which we judge the value of knowledge are often arbitrary and reinforce hierarchies of different ways of knowing, or sometimes, even what is worth knowing. Interrogating this sensibility becomes tricky, because all knowledge is not of equal value. For instance, I cannot seriously engage with those who claim that the world is flat, or who deny that climate change is a reality. When it comes to agrarian science, I also cannot accept farmers' assertions or findings without critical engagement. Scientific research and knowledge asserted by non-professional scientists is often discussed in the context of knowledge used to promote sustainable use of resources (as within the context of this dissertation), which is a generalization that may not be accurate (Fitting

2011:206). Communities are diverse and not everyone has the same concern for ecology. There may be different forces driving behaviour, both individual and social. As Sillitoe reveals: interpretation of shared knowledge will differ, depending on how it affects interests and "different interest groups may have different understandings of issues, with different perspectives and agendas, which they will seek to manipulate. Those more powerful can impose their view on others" (2007:11).

As knowledge, knowledge application, and behaviour are susceptible to social and cultural influences (Fitting 2011, Li 2014) it is important to recognize knowledge as process, and to be aware of the many factors that may influence how knowledge is created, transformed, utilized, and passed on. From another perspective, I also cannot blindly accept the assertions of scientists without critical engagement with their claims. This is actually an essential aspect of the scientific endeavour and one that sometimes gets lost in a society where science and scientific claims-making have become so enmeshed with corporate interests.

My critical engagement with the politics of science throughout this dissertation may appear nihilistic, however this is not my intention. I am passionate about learning and the possibilities of science. In truth my critical engagement comes from a place of hope, for we cannot change what we refuse to acknowledge. Isabelle Stengers (2018) advocates for a "slowing down" of science. In this slowing down, I believe there is the possibility for a more hopeful future.

6.2. Conclusion—A Politics of Mutual Enhancement and an Appeal for "Slow Science"

"*There is only one real mystery at stake, here: it is the answer we, meaning those who belong to this history, may be able to create as we face the consequences of what we have provoked*" (Stengers 2014 In Haraway 2016:44).

There were times throughout my research when I felt overwhelmed by the realities of climate change, by the devastation of species extinction, and of the realities of the lives of the farmers with whom I conducted my research. As I travelled throughout southern

Ontario, windows down, Matthew Good singing "Lullaby for the New World Order" blaring from my speakers, I passed through towns that had seen better days. Towns where the main street was tired and more businesses were boarded up than had "open" signs in the windows. With these realities it was sometimes hard to remain hopeful. It was during this drive that I began to dream about what a more sustainable future might look like. For instance, what if our decisions were not based on finding an acceptable threshold of exploitation, but instead were based on finding the best alternatives for mutual enhancement? What would this look like? How might this change our world for the better? I began to consider the idea of "sustaining relationships" as an alternative to sustainability.

Humans have complex relationships with many species that shape everything from politics, to livelihoods, to human health, to global commodity chains. Capitalism has shaped these encounters in very specific ways. This is not to deny the agency of other species, nor do I wish to ignore the reality that not all humans or societies have been complicit in creating these distinctive ways of relating. However, the realities of what Jason Moore (2016) has declared the "Capitalocene" require us to consider carefully how global capitalism has required certain ways of relating within ecology that have come at the expense of those (both human and others) who are considered disposable.

In order to address the complex challenges associated with mass species extinction and a rapidly changing climate, I believe we need new ways of relating. The concept of "mutualism" has specific implications in biology, referring to multi-species entanglements that result in each species in an interaction benefitting in some way from that interaction. In some cases, these relationships are interdependent (one species cannot survive without the other), but in other instances (like mychorriza—an association between fungi and trees) the relationship is not necessary but serves to enhance the survival or quality of life for each participant. I would like to advocate for what I call a politics of mutual enhancement, the basis of which is humility and acknowledgment of the right of every species to survive. This has echoes of Donna Haraway's vision of *flourishing* which requires a multi-species response-ability to create relationships and

commitments in order to increase the ability of both humans and others to flourish on a damaged planet (Haraway 2016:56, 138). A politics of mutual enhancement also has similarities to Hinchcliffe and Whatmore's "politics of conviviality" which provides a relational ontology in which particular kinds or individual entities thrive in combination with others whose capacities and powers enhance their own and who must attend to the messy business of living together (2006:134-136).

As I pondered what a politics of mutual enhancement might look like, my conversation with Gordon came to mind—specifically his discussions of lawn maintenance and his own willingness to let his ditches "grow wild" so that other species could maintain their habitat. How might multi-species relationships evolve differently if we took the time to consider our encounters and reflect on not just what we might want or need, but what others might need as well?

In some cases, farmers do have relationships based on mutualism with other species, such as the creation of "bee friendly" habitat or beetle banks to help encourage certain species that will help them in their farm production. In other cases, they are in the position of having to choose between which lives will be nurtured so that they might feed us, and which lives become expendable as a result. A politics of mutual enhancement does not preclude killing. In fact, these processes are integral to life and ecology through the complex processes that make up the food web. What we must take seriously is the difference between eating and dying, versus capitalist exploitation and waste. We often make decisions based on which lives we've determined are expendable, but the realities of ecology mean we rely on one another for survival. So when it comes to making decisions about who lives and who dies, what possibilities lie in our willingness to ask the question of "is this necessary?" In the context of agriculture, this might look like eliminating pesticide use, or avoiding the prophylactic use of pesticides and using them only in extreme cases of necessity. Or maintaining fencerows and refusing to cut down trees. Or employing farming methods that encourage species diversity.

A politics of mutual enhancement also extends to quality of life. As farmers attend to the living and dying of other species there is a responsibility to try, wherever possible, to protect against suffering. This means allowing animals the pleasure of being outdoors, and of interacting with one another. This means making sure animals are not confined in spaces too small or inhospitable, and when they are sent to slaughter, that their transport and death occurs in ways that attend to the enormity of their sacrifice. A politics of mutual enhancement requires empathy and an acknowledgement of our dependence on others for our survival.

A politics of mutual enhancement ultimately requires an imagined future. One in which there is hope for us all. It is only through the humility of realizing we are animals too, that we can dismantle the nature/culture divide and attempt to repair our relationships with the other species with whom we share the planet (Latour 1993). The fallacy of human omnipotence is reinforced by elevating humans to protectors of the planet, or of other species. It is a responsibility that we have proven time and time again that we are ill-equipped to deal with. A politics of mutual enhancement calls on us to dismantle species hierarchies and understand that we all have a place within Earth's ecology. Encouraging the survival of other species is not just preferable, but essential for the survival of humanity. One of the ways to encourage meaningful change is to examine our role as scientists and how we may be complicit (perhaps unintentionally) in reinforcing hierarchies about who matters.

I believe anthropologists have an important role to play in addressing the limitations of science, especially science which reinforces certain ways of relating under capitalist logic. Isabelle Stengers asserts that as participants in the knowledge economy, academic institutions have become complicit in encouraging "fast, competitive science" often in response to the imperatives of industry and to the detriment of more thoughtful and balanced scientific inquiry (2011, 2018). She calls on us to think critically of the rationality of scientific expertise that "all too frequently presents an innovation as 'the' correct solution 'in the name of science'" (Stengers 2018:4). In her book *Another Science is Possible: A Manifesto for Slow Science*, Stengers uses the same example that I have

regarding the assessment of GMO safety in advocating for “getting rid of the idea that there is a single ‘right answer’” and she insists that the solution is “an ensemble of practices” that produce “information” as opposed to “facts" (2018:3,60). She proposes scientific engagement across disciplines and listening to those who have a vested interest in the outcomes of science (the public), including engaging with non-specialists to broaden the scope of our inquiry and understanding (Stengers 2018).

Stengers suggests that “slow science” is “not about scientists taking full account of the messy complications of the world. It is about them facing up to the challenge of developing a collective awareness of the particularity and selective character of their own thought style” (2018:100). This should not be confused with reflexivity, but instead requires an approach to collective learning through the building of relationships with those who hold dissenting opinions from our own, but who share a common interest (Stengers 2018). I believe there is much to be gained from this form of engagement. Science is never neutral, as much as we might want or pretend it to be. What we choose to study is shaped by who we are and what we believe matters or is possible. The limitations of neutrality can be seen within my own work as I was forced to confront more complex understandings of the behaviour of both ecological and conventional farmers, or in being compelled to acknowledge that farmers who choose to use neonicotinoid pesticides use them because they are actually less toxic than other alternatives. It can be tempting to engage only with the discourses that reinforce your own hypotheses or political agenda and ignore that which confronts your assumptions and requires you to “slow down”.

Multi-disciplinary engagement and interaction with various stakeholders provide important avenues for thinking critically about “matters of concern” (Latour 2004). However, this type of engagement requires humility as opposed to hubris. In order to build relationships across difference and to learn from one another there needs to be respect for different ways of knowing. As Gan et al. suggest: “It requires moving beyond the disciplinary prejudices into which each scholar is trained, to instead take a generous view of what varied knowledge practices might offer” (2017:G2). This also includes

moving beyond the borders of academic disciplines, to engage with various ways of knowing and being in the world. There is much to be gained by moving beyond our disciplinary boundaries and engaging with diverse perspectives and knowledges. I have become aware, through the processes of this research, of my own limitations and where I might benefit from engagement with other thought collectives. Although my intent has been to unsettle the hierarchy of different ways of knowing, I can do this while acknowledging the enormous contributions positivist science has made to our understandings of ecology. Acknowledging this fact does not preclude me also acknowledging its limitations. Similarly, I can assert the important contributions of agrarian science, as other recent scholarship has acknowledged the unique form of knowledge held by agrarian citizens and other harvesters around the globe (see von Glasenapp and Thorton 2011, Murray et al. 2006), while also recognizing its weaknesses.

Like Isabelle Stengers (2018), I have embraced the call for "slow science." This quote from her book *Another Science is Possible: A Manifesto for Slow Science* was particularly compelling for me so I've chosen to include it despite its length:

> Knowing that one is sick creates a sense of the possible. We don't know what the strange adventure of the modern sciences could have been, or could yet be, but we know that doing 'better' what we are already in the habit of doing will not be sufficient for learning. It is a matter of unlearning an attitude of more or less cynical ('realist') resignation, and becoming sensitive once again to what we perhaps know, but only as in a dream. It is here that the 'slow,' as used in the slow movements, is adequate. Speed demands and creates an insensitivity to everything that might slow things down: the frictions, the rubbing, the hesitations that make us feel we are not alone in the world. Slowing down means becoming capable of learning again, becoming acquainted with things again, reweaving the bounds of interdependency. It means thinking and imagining, and in the process creating relationships with others that are not those of capture. It means, therefore, creating among us and with others, the kind of relation that works for sick people, people who need each other in order to learn—with others, from others, thanks to others—what a life worth living demands, and the knowledges that are worth being cultivated. (81–82)

As we attempt to confront the complex challenges associated with climate change, we must also confront the limitations of science to address them. Our salvation will not be found in complex theory or in the development of new technology, but in changing our

ways of relating. This extends not just to relationships within ecology, but those within science as well. We must engage critically, but deliberately, with different ways of knowing and being in the world. We need to "cultivate knowledge." The farmers in southern Ontario with whom I have worked are agrarian scientists who are "cultivating knowledge" as they attempt to enhance their adaptive capacity. As the mobilization of diverse knowledges will likely play a crucial role in helping to address the complex challenges of climate change, understanding the relationships that shape knowledge production, access, integration, and utilization is essential to creating a sustainable future for agriculture in Ontario—and beyond.

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Appendices

Advertisement placed in the Rural Voice to recruit research participants in 2016.

Western SocialScience

Research Participants Wanted

You are being invited to participate in a study that Kelly Abrams, PhD candidate researcher, and Dr. Andrew Walsh, professor in the department of Anthropology at Western University, are conducting.

Briefly, the study involves taking part in a short interview(s) about various aspects of agricultural production and policy in Ontario, including your personal views, experiences and stories. As a part of this investigation you may be asked about issues such as how you learned to become a farmer, how you access or share knowledge about farming methods, climate change, environmental sustainability, science-based regulation, genetically modified organisms and seed saving. It is anticipated that the entire interview will take 1.5 hours, over 1 interview session. You may be contacted to take part in a brief follow-up interview of 0.5 hours, over 1 session. The interview(s) will be conducted in a location that is comfortable for you, such as your home or a public venue of your choosing (such as a coffee shop). There will be a total of 40 participants.

Sample of Recruitment email sent to union local:

Dear ,

My name is Kelly Linton and I am currently doing my doctoral research on the issues facing agricultural producers in southern Ontario. I am interested in speaking with you and any other members of your local who might be willing to participate in a brief interview.

I originally set out to explore the debate over genetically modified alfalfa but my initial interviews have shown me that there are a number of important issues currently facing agricultural producers. Some issues that have come up include pollinator health, control over seeds, land grabbing, effects of government policies, and the fate of the family farm.

I would love the opportunity to speak with you at a time that is convenient. I know it is a very busy time of year so I am happy to come to you on a rainy day, evening or weekend. The interview will not take more than 1.5 hours.

I can be reached via this e-mail or on my cell phone at xxx-xxx-xxxx if you think you might be willing to speak with me and please forward my contact information to anyone you know who might be willing to participate.

Thank you so much for your time,

Kelly Linton

Sample Recruitment e-mail for potential research participant:

Good Morning,

My name is Kelly Linton and I am a PhD candidate in the department of Anthropology at the University of Western Ontario. I have been working with farmers in southern Ontario over the past year and a half exploring the role of farmers as practical experimenters and innovators. I believe the ecological knowledge of farmers will likely play a crucial role in helping to address the challenges associated with climate change. I would welcome the opportunity to speak with you about your experiences in farming.

Briefly, the study involves taking part in a short interview(s) about various aspects of agricultural production and policy in Ontario, including your personal views, experiences and stories. As a part of this investigation you may be asked about issues such as how you learned to become a farmer, how you access or share knowledge about farming methods, climate change, environmental sustainability, science-based regulation, genetically modified organisms and seed saving. It is anticipated that the entire interview will take 1.5 hours, over 1 interview session. You may be contacted to take part in a brief follow-up interview of 0.5 hours, over 1 session. The interview(s) will be conducted in a location that is comfortable for you, such as your home or a public venue of your choosing (such as a coffee shop). There will be a total of 50 participants.

If you would like more information on this study or would like to receive a letter of information

about this study please contact me at the contact information given below.

Thank you so much for your time,

Kelly Linton

PhD Candidate, Department of Anthropology

The University of Western Ontario

Western Research

Research Ethics

Western University Non-Medical Research Ethics Board
NMREB Amendment Approval Notice

Principal Investigator: Dr. Andrew Walsh
Department & Institution: Social Science\Anthropology,Western University

NMREB File Number: 105047
Study Title: Place-Based Knowledge Production and Sites of Exchange - Innovation and Adaptation in Southern Ontario Agriculture

NMREB Revision Approval Date: June 01, 2016
NMREB Expiry Date: April 17, 2017

Documents Approved and/or Received for Information:

Document Name	Comments	Version Date
Instruments	Sample Questions	2016/03/16
Recruitment Items		2016/03/16
Revised Letter of Information & Consent		2016/03/16
Revised Western University Protocol		2016/05/25

The Western University Non-Medical Science Research Ethics Board (NMREB) has reviewed and approved the amendment to the above named study, as of the NMREB Amendment Approval Date noted above.

NMREB approval for this study remains valid until the NMREB Expiry Date noted above, conditional to timely submission and acceptance of NMREB Continuing Ethics Review.

The Western University NMREB operates in compliance with the Tri-Council Policy Statement Ethical Conduct for Research Involving Humans (TCPS2), the Ontario Personal Health Information Protection Act (PHIPA, 2004), and the applicable laws and regulations of Ontario.

Members of the NMREB who are named as Investigators in research studies do not participate in discussions related to, nor vote on such studies when they are presented to the REB.

The NMREB is registered with the U.S. Department of Health & Human Services under the IRB registration number IRB 00000941.

[redacted]

Ethics Officer: Erika Basile ___ Katelyn Harris ___ Nicole Kaniki ___ Grace Kelly ___ Vikki Tran ___ Karen Gopaul ___

Western SocialScience

Project Title: Place-Based Knowledge Production and Sites of Exchange - Innovation and Adaptation in Southern Ontario Agriculture

Principal Investigator: Dr. Andrew Walsh, PhD, Department of Anthropology, Western University

Letter of Information

1. Invitation to Participate

You are being invited to participate in a research project investigating the environmental knowledge systems of agricultural producers in southern Ontario and how this information is shared in ways that may enhance resiliency to climate change. As someone involved directly with agricultural production, your personal experience and views are vital.

2. Purpose of the Letter

The purpose of this letter is to provide you with information required for you to make an informed decision regarding participation in this research.

3. Purpose of the Study

The purpose of this study is to investigate the role of farmers as practical experimenters and innovators and how their unique form of knowledge is then shared among emerging local, national, and transnational networks of farmers. The ultimate goal is to consider the extent to which such practical experimentation and knowledge sharing are inspiring social, technological and/or ecological innovations with the potential to enhance resiliency to climate change, while creating a more environmentally sustainable future for family farms in Canada. The project's objectives can be broken down into three categories: 1) To explore the environmental knowledge systems of southern Ontario farmers. What are their understandings of their local landscapes? What are the implications for combatting climate change? What are the implications for the maintenance of biodiversity and environmental conservation? 2) To explore in what contexts farmers share their unique knowledge and whether shared sets of social, political or economic beliefs play a factor in the facilitation of knowledge sharing. 3) To determine whether ethnoecological knowledge and producer networking are encouraging innovation with the potential to enhance resiliency to climate change and provide a more environmentally sustainable future for farming in Ontario.

4. Inclusion Criteria

Individuals who are men and women between the ages of 18 and 80 and who are members or former members of the agricultural community are eligible to participate in this study.

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5. Exclusion Criteria

Individuals who are under the age of 18 are not eligible to participate in this study.

6. Study Procedures

If you agree to participate, I would like to record (audio) our discussions, correspondence and/or short interview(s) about various aspects of farming and your beliefs about the value of food production, including your personal views, experiences and stories. Being recorded is optional and you will be asked to give written consent before any interviews are recorded. As a part of this investigation you may be asked about issues such as climate change, different farming methods, what resources you access or have accessed to learn about farming, genetically modified organisms, seed saving, Bill C-18 and the use of neonictinoids. It is anticipated that the entire interview will take 1.5 hours, over 1 interview session. You may be contacted to take part in a brief follow-up interview of 0.5 hours, over 1 session. The interview(s) will be conducted in a location that is comfortable for you, such as your home, on your farm, or a public venue of your choosing (such as a coffee shop). You may be asked if a visit to the site of agricultural production is possible, and if consent is given, a visit of 2-8 hours may be arranged so that the researcher has the opportunity to learn about agricultural production. There will be a total of 40 participants in this study.

7. Possible Risks and Harms

There are no known risks associated with your participation in this study.

8. Possible Benefits

You may not directly benefit from participating in this study but information gathered may provide benefits to society as a whole which include contributing to an increasing body of knowledge illustrating how the environmental knowledge systems of local peoples can contribute to documenting and understanding bio-diversity and how applying this local knowledge has the potential to create more sustainable environments.

9. Compensation

You will not be compensated for your participation in this research.

10. Voluntary Participation

Participation in this study is voluntary. You may refuse to participate, refuse to answer any questions or withdraw from the study at any time with no effect on your future.

11. Confidentiality

All data collected will remain confidential and accessible only to the investigators of this study. If the results are published, your name will not be used. Information from the study will be stored on a password-protected computer to which only the student researcher has access. If you choose to withdraw from this study, your data

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will be removed and destroyed from our database. While we will do our best to protect your information there is no guarantee that we will be able to do so. You may be contacted later for permission to use the data in other projects. Representatives of The University of Western Ontario Non-Medical Research Ethics Board may contact you or require access to your study-related records to monitor the conduct of the research.

12. Contacts for Further Information

If you require any further information regarding this research project or your participation in the study you may contact Kelly Abrams at [redacted] or [redacted] or my supervisor, Andrew Walsh at [redacted] or [redacted]

If you have any questions about your rights as a research participant or the conduct of this study, you may contact The Office of Research Ethics [redacted], email: [redacted]

13. Publication

The results of this study will be used towards a Doctoral Dissertation. If the results of the study are published, your name will not be used. If you would like to receive a copy of any potential study results, please contact Kelly Abrams at [redacted]

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Consent Form

Project Title: Ethnoecology, Values and the Fight Against Genetically Modified Alfalfa

Study Investigator's Name: Kelly Abrams

I have read the Letter of Information, have had the nature of the study explained to me and I agree to participate. All questions have been answered to my satisfaction.

Participant's Name (please print): _____

Participant's Signature: _____

Date:_____

Person Obtaining Informed Consent (please print): _____

Signature:_____

Date: _____

I agree to have my interview recorded and give permission for the content of the recording to be used for the purposes of this research project.

Participant's Name (please print): _____

Participant's Signature: _____

Date:_____

Person Obtaining Informed Consent (please print): _____

Signature:_____

Date: _____

Some participants may be contacted to take part in a follow-up interview. I give permission to be contacted for the purposes of a follow-up interview.

Participant's Name (please print): _____

Participant's Signature: _____

Date: _____

Person Obtaining Informed Consent (please print): _____

Signature: _____

Date: _____

Information obtained in interviews may be used in future projects. I give permission for my contributions to be used in future projects.

Participant's Name (please print):_____

Participant's Signature: _____

Date: _____

Person Obtaining Informed Consent (please print): _____

Signature: _____

Curriculum Vitae

Name: Kelly Linton

Post-secondary Education and Degrees:

The University of Calgary
Calgary, Alberta, Canada
2013 B.A. Honours Sociocultural Anthropology

The University of Western Ontario
London, Ontario, Canada
2019 Ph.D. Sociocultural Anthropology

Honours and Awards:

Social Science and Humanities Research Council (SSHRC) Doctoral Fellowship
2016-2019

Doctoral Excellence Research Award
2016-2018

Province of Ontario Graduate Scholarship
2017 (declined)

Province of Ontario Graduate Scholarship
2016

Regna Darnell Scholarship for Fieldwork in Sociocultural Anthropology
2015

Province of Ontario Graduate Scholarship
2015 (declined)

Social Science and Humanities Research Council (SSHRC) CGS- Master's Scholarship
2014-2015

Athabasca University President's Scholarship for a Visiting Alberta University Student
2013

Graduated top of my class - The University of Calgary
2013

The University of Calgary Transfer Scholarship
2007

Related Work Experience

Undergraduate Teaching Assistant
Faculty of Social Science
The University of Western Ontario
January 2014 - April 2019

Courses:
Introduction to First Nations and Indigenous Studies
Winter 2019

Introduction to Biological Anthropology and Bioarchaeology
Fall 2018

Many Ways of Being Human
Winter 2018, Winter 2017

Anthropological Approaches to Language
Fall 2017

The Foundations of Anthropology
Winter 2015, Fall 2015

The Production and Consumption of Global Commodities
Winter 2014

Guest Lecturer
Course: The Foundations of Anthropology
Religion, Worldview and Ontology
March 13, 2015 and November 17, 2015

Research Assistant
Department of Anthropology
The University of Western Ontario
September 2013 - December 2013

Publications:

Linton, Kelly

2019 On Eating and Killing: Multispecies Entanglements and Implications for Ecology. More-than-Human Worlds: A NatureCulture Blog Series https://www.natcult.net/on-eating-and-killing-multispecies-entanglements-and-implications-for-ecology/